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AVIATION SAFETY

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BEFORE THE

SUBCOMMITTEE ON AVIATION

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

UNITED STATES SENATE

NINETY-SIXTH CONGRESS

SECOND SESSION

ON

OVERSIGHT OF AVIATION SAFETY

AUGUST 25, 26, AND 27, 1980

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CONTENTS

Page

Opening statement by the Chairman 1

Opening statement by Senator Kassebaum 2

CHRONOLOGICAL LIST OF WITNESSES

August 25, 1980

Bond, Hon. Langhorne M., Administrator, Federal Aviation Administration; accompanied by Ray Van Vuren; Neil Blake; Clark Onstad; Walter Luffsey; and Charlie Huettner 3

Letter of October 10, 1980 16

Poli, Robert E., president, Professional Air Traffic Controllers Organization; accompanied by Michael Simons 35

Prepared statement 40

August 26, 1980

Howell, Jack, executive central air safety chairman, Airline Pilots Association; accompanied by John LeRoy, chairman, International Federation of Air Line Pilots Associations Working Groups on Crew Complement; John O'Brien, manager, engineering and operations; and William Edmunds 65

Prepared statement 92

Lowry, C. Ronald, vice president—research and technology, Aerospace Industries Association of America, Inc.; accompanied by Douglas R. Clifford, chief engineer, airworthiness, safety, and production, Boeing Co.; and George Jansen, director, flight operations, Douglas Aircraft Co 101

Questions of the committee and the answers thereto 107

Nysmith, C. Robert, Acting Deputy Associate Administrator, National Aeronautics and Space Administration; and Dr. Alan Chambers, Ames Research Center 95

August 27, 1980

Ignatius, Paul R., president and chief executive officer, Air Transport Association of America; accompanied by James Landrey, general counsel; and Clifton Von Kann, senior vice president, operations and airports 131

Prepared statement 144

King, Hon. James B., Chairman, National Transportation Safety Board; accompanied by William G. Laynor, Deputy Director for Operations, Bureau of Technology; Gerrit J. Walhout, Chief, Human Factors Division; and Edward C. Montgomery, Senior Air Safety Investigator, Aviation Accident Division, Bureau of Accident Investigation 111

Letter of September 30, 1980 123

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

Cushing, Lawrence C., president, National Association of Air Traffic Specialists, statement 157

Werjefelt, Bertil, president, Zenex Corp., letter of August 6, 1980 160

AVIATION SAFETY

MONDAY, AUGUST 25, 1980

U.S. Senate,
Committee on Commerce, Science, and Transportation,
Subcommittee on Aviation,
Washington, D.C.

The subcommittee met at 9:40 a.m. in room 235, Russell Senate Office Building, Hon. Howard W. Cannon (chairman of the committee) presiding.

OPENING STATEMENT BY THE CHAIRMAN

The Chairman. The committee will come to order. This morning's hearing marks the beginning of 3 days of aviation safety oversight, which are only an introduction to a continuing series of such hearings the committee plans to conduct. These 3 initial days will be focused on the human factor errors which have caused airline accidents and incidents.

Some might question our human factor focus when the current headlines are emphasizing equipment failures. Our response is simply that human failures have been the causative factor in 80 percent of aviation accidents while the computer equipment failures of recent headline fame have only presented potential safety questions, not any accidents.

Clearly, our first order of business is to attack the problems which surround proven causes of past airline accidents. In the longer term, we must not and will not ignore potential safety problems as we continue our oversight hearings, but the popular fixation on computer failures as an excessive hazard in air travel is simply not supported by the facts.

I believe the most important point to make in setting the stage for these safety hearings is to emphasize just how safe the air transportation system is today. Your chances last year of completing a scheduled airline trip safely were 99.9999032 percent. Or conversely, your chances of being involved in a fatal accident was less than one in a million. There is almost nothing in life you can do, including staying home, which is safer than getting on a domestic airliner.

Existing safety is the most important fact to keep in mind as we pursue these hearings, not because it's good public relations for the airline industry, but for the practical reason that when you have a system working as safely as air transportation, it is imperative to remember that wholesale change is not justified or desirable. Certainly, as demonstrated by calling these hearings, I believe we can and must continue to improve our superb air safety record. But we should never lose sight of the fact that what we're looking for are incremental changes to get at those last three decimal points, not dramatic changes which might jeopardize the six nines up front.

My message is that we have an important task in improving the safety of air transportation. But it's the task of a watchmaker, not a building renovator. As we will seek to develop over the next 3 days, there are potential solutions to minimize many of the human failures involved in past accidents. The solutions, however, will not be simple or easily found. Problems of the one in a million variety are by definition complex. But we should be pleased about the difficulty of the job before us. It's the kind of difficulty I wish we had throughout our Government. Past levels of success are so high that perfection is being demanded and that is indeed an arduous goal.

Senator Packwood, do you have an opening statement?

Senator PACKWOOD. No opening statement.

The CHAIRMAN. Senator Kassebaum.

OPENING STATEMENT BY SENATOR KASSEBAUM

Senator KASSEBAUM. Yes, I do, Mr. Chairman. I would like to just reiterate and support what you've said as far as the really very excellent safety record we have. I think that is because the airlines, the pilots, the controllers, the FAA, and NTSB have all worked very well together. I think our excellent safety record has been accomplished because the basic tenet of our philosophy has been that safety is the paramount consideration in all decisions regarding the requirements of the system.

If we're going to improve the system, we must stick to that premise. We must try the best we can to separate safety considerations from economic ones. We must apply this standard across the board—to the airlines, their pilots and our controllers. It must be crystal clear that we will allow no one to jeopardize the safety of the traveling public in an attempt to gain economic advantage.

In this regard, I'm particularly concerned about allegations of illegal work actions and threatened strikes of air traffic controllers. Grievances must be responded to. Pay and working conditions must be fair. But illegality must be dealt with swiftly and firmly.

Likewise, we must be convinced that the current issue of crew size is decided on the issue of safety, not economics. However the decision is resolved, we must know that it has been reached not in a way designed to save money for airlines or jobs for pilots, but lives of air travelers.

I hope that these hearings will give us an opportunity to recommit ourselves to the philosophy of safety first in air travel. Our focus this week will be the impact of human factors on safety. What I hope to learn from these hearings is what is best for the American public in terms of air safety and how Congress can reinsure the continued improvement of our system.

I appreciate very much the contributions of those participating in the hearings. I believe we can work together in our continuing effort to keep America's air transportation system the envy of the world.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Senator Kassebaum.

Our first witness today is the FAA Administrator, Langhorne Bond.

Mr. Bond, before you begin I want to note that you occupy a position which in recent years has been the center of much controversy. In fact, I have noted that your resignation has even been called for by a gentleman from California. So I thought it might interest you to know that I talked to another government official here in Washington the other day whose resignation has also been called for by a gentleman from California; but he told me that he doesn't plan on accepting the invitation, either.

All right, sir. You may proceed.

STATEMENT OF HON. LANGHORNE M. BOND, ADMINISTRATOR, FEDERAL AVIATION ADMINISTRATION; ACCOMPANIED BY RAY VAN VUREN; NEIL BLAKE; CLARK ONSTAD; WALTER LUFFSEY; AND CHARLIE HUETTNER

Mr. Bond. Will Rogers, Mr. Chairman, once said he belonged to no organized political party, being a Democrat. My resignation is called for by a Democrat; President Carter's was called for by a Republican. There was a contingent demand for my resignation: If the Oakland computer wasn't fixed, then I should quit. But I hope to get that computer fixed. Then I may presumably be able to stay in office.

Before I begin my testimony, I would like to express my personal gratitude to you, Senator Cannon, and members of the committee, on behalf of myself and the aviation community for your help in intervening last week to save the aviation safety money that was threatened during the second budget resolution. That is an enormous contribution to our system and we all worked together to keep it in at the levels that had been asked for.

I am afraid not enough attention has been paid to what happens quickly and sharply in the Congress. I for one am very grateful indeed, and I know all those in this room share that feeling.

I welcome the opportunity to appear before you today to discuss the human factor causes of air carrier accidents. Much attention has been focused recently on the performance of equipment in aviation, while little has been said about the human element which bears the greatest responsibility for aviation accidents.

Before discussing FAA's various programs concerning human factors, I would like to advise the subcommittee of five major steps we are taking in response to needs we have identified in the human factors area:

First, we are issuing a notice of proposed rulemaking which would allow the Administrator of the FAA to request and obtain flight data recorder information and cockpit voice recorder information from air carriers, air taxis, and commercial operators. This information would be used to study the human factors problems associated with aircraft operation and design to determine what, if any, further regulatory changes should be made to enhance aviation safety.

Moreover, these onboard recordings offer the opportunity to study systematically such things as cockpit crew management and workload, pilot/controller inferface, and the performance of new airborne systems.

We are also issuing an NPRM designed to prohibit the performance of duties and activities in the cockpit of air carriers, commercial operators, and air taxis which are unnecessary for the safe operation of the aircraft. These nonessential flight duties such as using company radio frequencies to order galley supplies, confirm passenger connections and make hotel and car rental reservations can create potentially dangerous distractions for the cockpit crew. We believe that the proposed elimination of nonsafety related duties and activities would improve cockpit discipline and, thus, assist in reducing the possibility of pilot error.

We intend also to issue a notice of proposed rulemaking that would allow the FAA to periodically review the type certification basis of aircraft in service, and to require such changes as may be necessary to insure that aircraft of that type design meet the level of safety current at the time of review. The current regulations lock an aircrafts airworthiness level into the regulations effective at the time its type certificate was applied for, regardless of the number of changes that are made to the aircraft or how old and outdated those regulations may be.

We anticipate that the initial review process will begin approximately 8 years after certification, with a determination regarding the adequacy of the aircraft's level of safety being issued by the 10th year. Subsequent reviews would likewise follow this 8- to 10-year cycle.

We are also in the process of developing a notice of proposed rulemaking that would require line oriented flight training, LOFT, as part of air carrier simulator recurrent training programs. This rule would require those air carriers with approved flight simulator training programs to include LOFT as an integral part of their recurrent training. LOFT offers the potential for correcting a wide range of human factors problems through simulator training.

We have scheduled a 2-day human factors workshop in October, which will bring together knowledgeable people from Government, industry, the military, and consumer groups to discuss human factors issues relating to crew workload. The workshop will cover a variety of subjects such as workload measurement techniques in the present and future ATC environment, the safety relationship between crew workload and crew complement, and the application of inflight data for use in human performance studies. It will also explore the question of simulating workload with two or three crew members.

I would like to point out as I have done in my decision on the certification of the DC-8-80 which will be released tomorrow, that each of these initiatives will address the concerns of the Air Line Pilots Association, ALPA, that while the DC-9-80 may be safe today, it would be safer in the future with three crew members. That is the union's contention.

The FAA's proposal will cause the data base to be assembled to test the allegations and permit changes in this and other future aircraft, should the data base and further human factors analyses prove out ALPA's claims. Let me emphasize, however, that I have found the DC-9-80 is capable of being flown safely with two crew members.

To strengthen our human factors programs, last year I established the DOT/FAA task force on human factors in the national aviation system. The Task Force is under the direction of the Associate Administrator for Aviation Standards, Walt Luffsey. It has been given the broad-based assignment to coordinate the FAA's human factors programs and to study the implications of current and future developments in flight operations, air traffic control, and aircraft certification with respect to the potential for human error, and to state the requirements for FAA research and development to insure that new equipment and procedures are designed to be fully compatible with human limitations. Our emphasis is placed on achieving a better understanding of the impact of advanced technology on the performance of the controller and the flight crew.

We believe these steps will provide us with short-term benefits to safety, and will provide a good foundation on which to launch further long-term efforts designed to minimize human error in our air transportation system. The relevance of these steps to the promotion of safety will become clear as I progress in my discussion of human factors.

In looking at human factors, we need to recognize that there are two major elements which must be addressed, both as separate elements and an integrated unit. I am referring to controllers and pilots and the interface between the two groups. Human factors play an important rile on the ground as well as in the air, and the safety of our air transportation system hinges upon proper and disciplined performance by controllers and pilots.

Though controller caused accidents have been rare, we have experienced an increased number of system error reports in recent years. In the terminal environment, system errors increased from 290 in 1977 to 380 in 1979. In the en route environment, system errors increased from 217 in 1977 to 231 in 1979.

Over 90 percent of those system errors occurred as a result of human error, from causes such as inattention to duty, poor judgment, lack of coordination among controllers, failure to properly identify aircraft, and poor communicative skills. Each system error is carefully investigated and the cause identified by a system error review board.

If you ask us how, and perhaps even why, a specific system error occurred, we can tell you. If, on the other hand, you ask us why the aggregate increase in system errors, we have no concrete or scientific answer. It is an area of human factors we have looked at, but it is apparent to us that much more analysis needs to be done.

I assure you if we had a good answer, system errors would be on the wane. The increase in system errors illustrates how important human factors are to the safety of our system, and just how elusive the answers can be.

On the human factors side, there are a variety of things we have done to improve the performance of our controller work force. We have worked to refine our entry requirements and our training procedures. We have provided simulators at our training academy as well as at our air traffic control facilities so that complex air traffic problems can be worked on in an operational environment without safety hazard. We have initiated various programs in our facilities to provide better supervision and to instill in our work force a greater spirit of professionalism. We have sought to introduce more uniformity in the system through the greater use of standard operating procedures.

We are looking at an optimum air traffic control sector arrangement, both in the context of visibility of display and accessibility of input/output devices. We will be analyzing proposed changes to the data information displayed to controllers on ATC system displays in an attempt to define an optimum format which will permit the most efficient use of display data under heavy traffic conditions. We are working to develop controller performance measures which will support the development of an optimized electronic tabular display subsystem and to evaluate productivity and performance enhancements achievable from this system.

I want to depart from my text for just a second here to add that the human factors matter in regard to our controller work force has an additional complexity which is not present with our other work on human factors. And that is that not only do the usual matters apply, but also the matter is complicated by the fact that the FAA, which sets safety rules with regard to our work force, is also acting in an atmosphere of unionism, we are management and the folks on the other side are labor.

Last week in Chicago we had an example of one such complication that arose. On Friday, a week ago last Friday, the controllers in the O'Hare tour staged an illegal strike, as defined by the Federal courts, which is a withholding of full optimal services, and slowed down our air traffic control system at O'Hare. Almost 700 flights were delayed at O'Hare Airport more than 30 minutes. Seven hundred people were required to stay overnight in hotel rooms because they'd missed connections or couldn't get on the flight that they wanted to get on at all.

We have stepped into this matter as best we can by counseling, by the notification of disciplinary actions that will be taken which ultimately could lead to dismissal. We have secured from a Federal judge in Chicago a temporary restraining order and the U.S. attorney in Chicago is working on the possibility of a detection of a conspiracy for this criminal action, because withholding of service is a crime under Federal law. That is a matter to be determined later.

We are initiating an effort to examine the potential impact of computer aided reasoning on air traffic control tasks in an automated environment. Two efforts are underway; one through an FAA agreement with the Defense Advanced Research Projects Administration and the Rand Corp., to examine the applications of computer aided decisionmaking; the other, a study being undertaken though an interagency agreement between NASA and the Office of Naval Research to determine and analyze problems associated with controller acceptance of computer aided decisionmaking.

We also will be undertaking a project intended to demonstrate the feasibility of automating routine air traffic control processes. Part of this effort will be an assessment of the capability of such an automated system to enhance controller performance in high workload situations and assure vigilance during routine operations.

In another effort, we intend to determine the impact of aircraft equipped with cockpit displays of traffic information—CDTI—on controller workload, on the optimum balance of responsibility between controller and pilot in a CDTI environment, and to establish the impact of CDTI on the safety, efficiency, and capacity of the air traffic control system.

In short, Mr. Chairman, we are very concerned with the human factors problems affecting controllers. We have already undertaken a number of efforts to better define these problems, and intend to undertake more in an effort to reduce the possibility of human error on the part of our controller workforce. You may be assured that the subject of human factors will play a major role as we progress in our efforts to define and build the air traffic system for the future.

I would like now to turn to a discussion of human factors as they relate to pilots. Historically, pilot error has been a contributing factor in the majority of aircraft accidents. NTSB data from 1975-78, for example, shows that approximately 66 percent of air carrier fatal accidents, 79 percent of commuter fatal accidents, and 88 percent of general aviation fatal accidents were caused by pilot error. Likewise, pilot error has played a significant role in aviation incidents, which are occurrences that fall short of the seriousness of accidents but are an important indicia of the performance of our system. NTSB findings have confirmed that errors of judgment and poor management by the cockpit crew are a significant factor in a majority of accidents and incidents.

The human factors cause of accidents has long been of concern to the FAA, but has proven one of the most troublesome problems to solve. The need to devote significant attention to this problem was pointed out by a DOT task force in 1975 which stated that the "FAA must undertake a major safety research program to assure that future aircraft designs make optimum use of crew capabilities, and to insure that future systems are designed around reasonable criteria for human error." In partial response to this recommendation, the FAA's Office of Systems Engineering Management—(OSEM)—undertook an in-house study to identify those human factors problems associated with air carrier and general aviation accidents and incidents. As part of this program, the FAA solicited the comments of both industry and government groups. The results of that study and the feedback received from the various groups were then used to formulate a program of human factors research aimed at reducing pilot error.

Based on our review of air carrier accidents and incidents, we believe that the most significant human factors problems include: Air traffic control interface; flight deck management failure; fatigue; crew workload; behavioral problems; aircraft design; and medical and toxicological problems. Let me touch briefly on each.

Air traffic control interface—problems in the interaction of the flight crew with the air traffic control system—can be a contributing factor in aircraft accidents. Possibilities for such problems must be thoroughly evaluated with respect to new systems. Systems such as the discrete address beacon system—(DABS)—data link for the automatic transfer of data allow for a more efficient means of transferring data between pilot and controller, but must be studied to assure that they have no negative human factors effects. Systems like cockpit display of traffic information—(CDTI)—and other airborne systems may have workload and coordination effects on both the cockpit crew and controller that must be understood before implementation.

Flight deck management failures including inadequate discipline, poor crew coordination, and failure to follow required procedures present another significant human factors problem. These problems, which have resulted in several accidents in recent years, occur for two general reasons: motivational failure and managerial failure.

Motivational failures occur when the flightcrew willfully fails to perform a function properly; for example, requesting to land on a shorter crosswind runway to minimize taxi time, continuing descent after a ground Proximity warning system alert, or discussing nonpertinent subjects during a critical phase of flight. Managerial failures, in contrast, result from an unintentional deficiency in judgment, training or inadequate procedures. Managerial failures have occurred, for example, when a captain failed to clearly delegate responsibility for flying the aircraft to the first officer after problems occurred with the landing gear which required him to devote his full attention to troubleshooting of the electrical system, and from the failure of the first officer to point out emphatically to the captain that a critically low fuel status required an expedited landing.

The legislative authority we have requested recently to increase the dollar amount of civil penalties that can be assessed by the FAA for regulatory violations would provide a stiff deterrent to willful motivational failures.

Fatigue as a factor in the cause of aircraft accidents can be defined as the "detrimental alteration or decrease in skilled performance related to duration or reptitive use of that skill, aggravated by physical, physiological, and psychic stress." Air safety investigators generally agree that many erroneous decisions and inappropriate or delayed actions associated with aircraft accidents may be attributable to fatigue. But, there is no test or index for the quantitative measurement of fatigue in an individual pilot or controller.

FAA and industry efforts to decrease fatigue-inducing physical and environmental factors associated with flying such as noise, vibration, and hypoxia have contributed greatly to air safety.

In addition, we are working to understand better the influence of psychological stress on fatigue-related accidents. Though psychological stress is not readily quantifiable, it has been shown to be closely related to human performance.

To deal further with the subject of crewmember fatigue, we recently issued a supplemental NPRM that takes into account the duty time that crewmembers put in—that is, the time from when they report to work until they go off duty—along with actual hours of flying. This proposed change recognizes that time spent preparing for flight and waiting between flights can add to crew fatigue.

Crew workload is also a factor which can affect safety. Safety may be affected by workload being too low as well as too high. Excessively low workloads may cause a degradation in cockpit discipline which has a negative effect on safety. Similarly, excessively high workloads can have a negative effect on safety, by causing confusion and allowing inadequate time to monitor critical systems or to perform critical tasks. We are, therefore, continuing to study crew workload with emphasis placed on the workload effects of airborne automation systems, new technology instrument displays, division of responsibility between crewmembers, and division of responsibility between the flightcrew and air traffic controller.

Behavioral factors are perhaps the least well understood of the major problem areas. These factors range from minor problems such as interpersonal conflict between crewmembers, to temporary stress resulting from family difficulties, to debilitating mental illness. The entire spectrum of behavioral problems can cause or contribute to aircraft accidents. I would point out, though, that it is only in the most clearly defined cases that accident investigators can conscientiously attribute the cause of the accident to behavioral factors.

Behavioral problems associated with aircraft accidents may go undetected because pilots and controllers tend to conceal these facts from investigators for various reasons including potential legal liability and feelings of guilt. Moreover, the civil investigating authorities have in the past generally lacked the sophisticated mental health expertise needed to evaluate the evidence of behavioral problems if uncovered.

Aircraft design improvements have the potential for reducing pilot error. It is well established that the application of state-of-the-art human factors design engineering including an increased level of standardization in flight deck equipment, such as standardized computer keyboards and symbolic representations on cathode ray tube flight displays, can decrease the probability of human errors. This has been documented in numerous reports by the U.S. military, by past studies of the NTSB, and in recent FAA reports on cockpit standardization. Our research is continuing with respect to conventional flight deck instruments as well as advanced display techniques.

Medical problems may be subtle, acute, or chronic. Acute conditions such as heart attacks, strokes, or seizures can lead to complete or partial incapacitation of a pilot or controller. Chronic diseases can also be incapacitating, having a deleterious effect on both flight crew and controller performance. FAA's medical certification process seeks to identify medical problems in flight crewmembers and controllers and deny certification to those individuals determined to be unsafe. We also do our best to keep abreast of advances in medical science with a view toward incorporating in our medical certification program those elements which will enhance safety.

Toxicological factors may result in decreased performance, of a crewmember, leading to an accident. Toxins affecting performance can come from numerous sources, including cargo aboard the aircraft, toxic gases from combustion, or from alcohol or drugs consumed by the pilot or controller. These factors are monitored in the Aviation Toxicology Laboratory at our Civil Aeromedical Institute in Oklahoma City, where toxicological assessments are conducted in about 65 percent of the accidents in which pilots are killed. Over the years, these studies have resulted in an effort to educate the civilian aviation community regarding dangers associated with exposure to toxins. We intend to continue our pilot education program regarding toxins and air safety, as well as our toxicological studies of pilots killed in accidents.

In 1978, our engineering and development organization undertook concentrated efforts in an aircrew performance enhancement and error reduction program and a counterpart program, the controller performance enhancement and error reduction program. We are also working in close partnership on human factors studies with the National Aeronautics and Space Administration and the Department of Defense.

These activities will utilize cockpit simulation facilities which are located at our own technical center, at the NASA Ames Research Center, and the NASA Langley Research Center, as well as air traffic control simulation facilities located at our technical center. These facilities will help us perform analyses involving both pilots and controllers to examine existing and future airborne and ground systems. We are strengthening our human factors capability and facilities at the technical center to permit a concerted attack on these problems. A variety of different activities are being undertaken, including an evaluation of heads-up display, an analytical study of future cockpit information requirements, an aircraft alerting system standardization study, a runway/taxiway transgressions study, and an analysis of pilot workload measures.

These engineering and development programs should provide us with greater insight concerning human factors and enable us to modify various elements of our system to reduce the possibility for human error.

We intend to continue the assessment of crew member workload as an integral part of new aircraft certification by utilizing not only proven techniques but by develping and evaluating a new technological base to assess cockpit crew workload. As cockpit automation is employed and new technology systems are utilized, we are continuing to upgrade our crew workload and crew complement analyses to insure safe crew complement and level of workload. This requires an analysis of the workload/safety relationship, taking into consideration such things as division of duties in the cockpit, division of responsibilities between the flightcrew and the controller, effect of command responsibility, and the effects of increased cockpit automation.

We will also be analyzing those physiological factors such as: Self-imposed stress; commuting time to duty station; dietary effects; use of tobacco, alcohol, and drugs both illicit and prescribed which may be contributing factors in aircraft accidents.

With the introduction of new flight system concepts, we have found it necessary to evaluate air traffic and flight operational scenarios to determine the workload impact and coordination between the flightcrew and the air traffic controller. This analysis will be especially useful in assessing the effectiveness of data links.

Our air traffic control system automation project has as a major element research to determine the best utilization of the human controller in an automated air traffic control system.

The subcommittee is well aware of the use of simulators today in assessing pilot performance. The role of simulation has been further enhanced by the advanced simulation regulation which went into effect on July 30. The sophistication and realistic nature of advanced simulators now available provides us a great opportunity for pilots to perform maneuvers which could be hazardous in flight, but which are extremely beneficial in developing the capability to deal with inflight emergencies. Moreover, simulators provide the opportunity to introduce windshear and other elements into the training scenario which would not otherwise be possible. The use of advanced simulators integrated with line oriented flight training programs can provide a significant improvement in crew coordination training and can also be used to correct other human factors problems. I have with me today an FAA expert on flight training simulators who can provide substantially greater insight to the subcommittee on the present and possible uses of simulators in advancing pilot skills.

Mr. Chairman, that completes my prepared statement. My associates and I would be pleased to respond to questions you may have.

The CHAIRMAN. Thank you very much, Mr. Bond, for a very comprehensive statement. I think that is very helpful in letting us know what is being done and how you see the problems.

Your announcement of an NPRM aimed toward reviewing flight data records and cockpit voice recorders was a most interesting proposal. What kind of cooperation do you expect to get from the professional pilots on this idea?

Before you respond to that, tell us how the recorder operates.

Mr. BOND. Well, there are two recorders, Mr. Chairman. There is a cockpit voice recorder and a flight data recorder. The cockpit voice recorder has a microphone in the cockpit that picks up all cockpit discussion, not only the air traffic control part of it, which we record on our end of the system, but also conversation in the cockpit.

It has turned out to be a very useful analytical tool to the Safety Board in the finding of probable cause of accidents. It picks up everything—background discussion, and so on.

The flight data recorder is largely an engineering tool which has data tracks, in the case of the later aircraft, many, many data tracks, which record important aspects of the flight of the aircraft such as air speed, angle of attack, level of thrust of the aircraft, all sorts of performance indices which are recorded and which are then broken down in case of an accident.

And the recording box for these two systems is located generally in the rear part of the aircraft, and it is fire proof and flame proof and shock proof to the greater extent that we can make it, so that it will survive even a catastrophic crash, so we are able to dig it out and look at it.

Our proposal here, which has not been adopted yet, will permit us to pull the information out of these systems during routine operations of the aircraft.

Now, your question about how the pilot union would look at this is another matter.

The **Chairman**. Let's get a little more background here now. You indicated that it's separated from the cockpit itself—both of those instruments. Now, what triggers them? Are they started automatically with the start of the airplane, or must they be triggered by operation of the captain? And can they be turned off?

Give us a little more background information on this.

Mr. **Bond**. I will let Walt Luffsey respond to that, Mr. Chairman. Walt Luffsey is our Associate Administrator for Aviation Standards.

Mr. **Luffsey**. They are activated with aircraft power. When the aircarft is powered, they are activated.

The **Chairman**. We frequently hear the question raised about erasing. Tell us about the erasing problem.

Mr. **Luffsey**. With regard to the cockpit voice recorder, some aircraft have the capability of an erase feature by depressing a button or moving a switch. We are suggesting that that should be inhibited for the purposes of our kind of analyses and it would be done so on demand.

The **Chairman**. Don't they automatically erase after recording for a specific period of time if no incident occurs?

Mr. **Luffsey**. Yes, sir, the cockpit voice recorder records for a period of 30 minutes with a self-erasing feature and re-records. In other words, a continuous loop.

The **Chairman**. And it can also be erased on the ground in a number of them; is that correct?

Mr. **Luffsey**. Yes, sir.

The **Chairman**. Are you proposing to change that so there would not be an erasing feature?

Mr. **Luffsey**. Yes, sir, we are proposing to inhibit the erase function. The only way to stop the recorder then will be to stop it in motion, but not to erase, pop the circuit breaker, or throw a switch on demand.

The **Chairman**. All right, Mr. Bond, you can take up there with my question.

Mr. **Bond**. My understanding is that the Airline Pilots Association will testify subsequent to me. The question is better addressed to the folks who will appear then.

But we have taken our thrust from statements from the union. Let me quote from the 1980 issue of the Airline Pilots magazine:

> What manufacturers in authority do studiously ignore is the real world of aviation, which is a complex, varied and ever changing scenario in time and place. This is the world into which we the pilots have to pitch our fallibility.

So that is one statement which would support the use of real world data extraction.

Another quotation from ALPA is,

> Deficiencies in the FAA certification process and unsubstantiated conclusions have reached—workload. We have said we have no specific workload data to justify some of our conclusions. A man's limitations are not given sufficient weight in the FAA certification process

that would include looking into the real world of airline operations.

And then an ALPA spokesman, Captain John Leroy, stated,

> FAA should recognize that flying an airliner requires the cockpit crew to perform many duties not directly related to safety, but all of which form performance.

The **CHAIRMAN**. Would the FAA propose to use that type of nformation for punitive action or as an educational tool to deter- nine improvements that could be made?

Mr. **BOND**. Clark Onstad is our chief counsel.

Mr. **ONSTAD**. Mr. Chairman, today we use flight data recorders in onjunction with enforcement efforts when there is other corrobo- ating evidence which starts us down the path of a violation. There vould be no change in that regard.

With regard to cockpit voice recorders, we do not use that for nforcement purposes today; they would not be so used in the uture. There would be absolutely no change in enforcement fea- ures in this proposal.

The **CHAIRMAN**. So this is not proposed as an added tool to ermit you to take punitive actions.

Mr. **ONSTAD**. Absolutely not, sir.

The **CHAIRMAN**. I am inclined to support this idea as a tool to nprove performance in the cockpit. But I would like to see what ubstantive objections the pilots might have to the specific roposal.

When do you propose to issue your NPRM on this, and do you ntend to have a public hearing or just accept written comments or hat?

Mr. **BOND**. It will be signed this afternoon and submitted to the ederal Register this afternoon, Senator. So it will go over immedi- tely for publication.

We haven't decided about a public hearing yet, but it's a distinct ossibility.

The **CHAIRMAN**. One further question on the proposal's aspects. the event of an accident, the voice recorder is recovered, and is at turned over to the NTSB directly as sealed instrument?

Mr. **BOND**. The Safety Board takes possession of it and is respon- ble for data extraction in case of an accident and is in charge of ose boxes.

The **CHAIRMAN**. Is that by law or by regulation?

Mr. **BOND**. I believe it probably would flow from the procedure at the safety board has charge of accident sites and all the idence that is thereto.

Mr. **ONSTAD**. Mr. Chairman, it stems from that basic statutory ovision which gives them statutory authority on accidents or cidents. By regulation they have implemented that further.

The **CHAIRMAN**. It's the FAA's responsibility to see that those corders are in the airplanes; is that correct?

Mr. **ONSTAD**. That's correct.

The **CHAIRMAN**. As part of your inspection process, do you exam- e the recorders to see if they are operating properly?

Mr. **LUFFSEY**. It is a required piece of equipment. It is listed on e MEL and must be operative.

The **CHAIRMAN**. Does the pilot have a checklist to see if it's erating, is it part of the checklist, and if it isn't operating, does write that up?

Mr. **LUFFSEY**. Yes, sir; there is a test procedure in the checklist. e checks to see if it's operating.

The **CHAIRMAN**. If it is not operating, is that grounds for not ing the airplane?

Mr. **Luffsey**. Being a MEL piece of equipment, normally, you can proceed to the next place of landing where the repairs can be accomplished if you happen to be at a place where it can't be. Otherwise, it will be fixed before they go.

The **Chairman**. I would like to ask you a few questions about advanced simulator training. We have reviewed airline accidents over the past 5 years. As I believe you know, there is a disturbing pattern in the vast majority of the accidents. The crew gets distracted by a problem of some type and an accident occurs. Not because of the original problem, but because no crew member pays primary attention to flight basics.

That is, staying above minimum approach altitude, maintaining fuel status, et cetera. Over and over, we see this pattern which would seem to point toward a need for more training which will help flight crews as a unit manage those types of situations.

As you testified, the FAA is moving in this direction with law, and the recent advanced simulator regulation. But I have some questions about the speed with which you are moving.

When do you expect to issue a RPM on line oriented flight training?

Mr. **Bond**. Senator, Charlie Huettner, who is our expert on this subject, is here. If you don't mind, I will ask Charlie to answer the question.

Mr. **Huettner**. The basic problem is the type of training, not that we need more. We noticed in 1975, that simulation needed to be strengthened because of the type of training we need to present. NTSB has shown us over and over that the problems of human relations factors are necessary and we looked into the type of simulators available and found there was not a capability within the airline simulators to actually present the training we wanted to go to.

Our first step was to come out with the advance simulation regulation, which is just now into effect. Once these simulators have been—are in common use, we are then able to revise the training program to present the types of training such as line oriented.

Mr. **Luffsey**. Training where we can look at the entire crew in environmental and abnormal malfunctions.

The **Chairman**. Five years ago Eastern applied for, but was not granted, permission to operate under F, so they could implement law. To quote Captain Beach at a recent NASA seminar, "Since ours was a special case, we felt strict compliance with the regulation would not provide flexibility needed to shift emphasis from training in manipulating skills to training in management skills. We were unable to obtain the exemption and LOFT was put aside for a time."

Why did FAA deny Eastern that exemption, if this is something you are trying to go to?

Mr. **Huettner**. At that time we had an exemption underway with Northwest Airlines. We didn't want to get into a situation where we had five different experiments going on at once. LOFT exemption was actually brought into the regulation to permit all airlines to go to LOFT training in May of 1978. So it is now permissible on all airlines.

We felt at that time that the original airline, Northwest, doing that experiment, was sufficient.

The **Chairman**. Senator Kassebaum, my 10 minutes is up.

Senator **Kassebaum**. I have several questions that would, I think, best would be addressed to both witnesses, so I will hold some of those. But I have one for you, Mr. Bond, and it ties somewhat to the new concept of trying to obtain access to the cockpit voice recorders.

It has been shown that the second most common element contributing to aviation accidents is weather. In a recent accident involving a commuter, apparently the pilot was not given the most recent information about severe weather.

I am wondering what the problem is. Is there sufficient staffing; poor communication between the pilot and controllers?

Mr. **Bond**. Ray Van Vuren is director of our air traffic service and is familiar with the case. Perhaps Ray can talk about the whole subject of weather information for pilots and also the particular question, the Air Wisconsin crash.

Mr. **Van Vuren**. Yes, ma'am. Under the—the Air Wisconsin accident is still under investigation by NTSB. There is a public hearing, I believe, scheduled for September 16.

What we have found so far is that there was a segment, a severe weather warning, that was out at that time and delivered to the center. It was sent 40 minutes after it was issued by the National Weather Service. So for 40 minutes it sat before the sector actually controlling the airplane issued it.

Why that happened, we don't know. Our policy requires you to put it out immediately. Normally it is handled by a weather coordinator which we have at the facility, and also we have a weather center service unit staffed by National Weather Service at our center. We have 18 centers and are putting together 3 more within the next year.

Senator **Kassebaum**. Does this staff meteorologist talk directly to the pilot?

Mr. **Van Vuren**. No. The National Weather Service meteorologist is paid for by the FAA. They forecast and also have access to National Weather Service radars themselves, where they can monitor severe weather and storms. They in turn pass it on to a weather coordinator, which is normally an FAA air traffic control specialist, a supervisory type specialist in a facility, that would disseminate it to the affected sector. He does this through the computer or manually, either one.

Senator **Kassebaum**. I see. Later in the hearings there will be some testimony which will indicate that there are some things the FAA could be doing that would substantially reduce potential human error in the landing process. For instance, it is suggested that more instrument landing systems could be installed, more runways could be improved, and windshear detection devices could be installed on planes.

Being a member of the Budget Committee, I hesitate to ask this; but what are the priorities of these items within the FAA budget?

Mr. **Bond**. Well, the question is, I guess, how important are they? And each in its own right? And then what priority do they have within the budget?

They are very important to us. I guess the best way to answer the question is that their relative priorities to look at the historic pattern of investment we have made with our capital budget over the years. In the early 1970's the larger amounts of money going into the air traffic controller capital account, our F. & E. account, was first established. It was used in those days to greatly expand the radar coverage that our approach control facilities and centers had, and to automate the system to carry the very large volumes of traffic that we knew were coming ahead.

Those programs are not complete. But they are almost complete. In fact, we are getting into second generation iterations of the computer, for example. So they really predominated in investment in the 1970's. And the reduction in midair collisions and increased capacity realized as a result, I think, clearly shows the payoff.

We are now investing more money into instrument landing systems. I judge, as a historical statement, there are many, many going in. We recognize the importance operationally of increasing the number of ILS's in our system. They reduce the minimums quite significantly. I can't give you the exact number, but I believe both installed and in the process of being installed, we will now be looking at almost 800, 850-some ILS's in the United States which is greater than the number in the rest of the entire world.

Senator **Kassebaum**. I wonder if you could supply for the record the number of commercially served airports which lack airport navigational equipment such as visual approach slope indicators or grooved runways and towers?

Mr. **Bond**. We would be happy to do that. I believe in my testimony before the other body last week we provided a breakdown of that information. The numbers are quite dramatic. They go from like 200 VASI's to 1,000 in 7 years.

Senator **Kassebaum**. Thank you.

[The following information was subsequently received for the record:]

Department of Transportation,
Federal Aviation Administration,
Washington, D.C., October 10, 1980.

Hon. Howard W. Cannon,
Chairman, Subcommittee on Aviation, Committee on Commerce, Science and Transportation, U.S. Senate, Washington, D.C.

Dear Mr. Chairman: Thank you for providing us the opportunity to correct the transcript from your August 25 hearing on Human Factors.

In response to Senator Kassebaum's question, there are currently 500 air traffic control towers, 2741 approach slope indicators, 777 instrument landing systems (including 39 military systems), and 322 surface treated runways throughout the National Aviation System. It should be noted that the runway surface treatments include not only grooving, but also wire combing, porous friction courses and other types of surface sealants which reduce runway slipperiness. The following is a numerical breakdown of certificated air carrier airports which lack various facilities:

Certificated air carrier airports with schedules service	454
Without towers	182
Without VASI's	43
Without ILS's	88
Without treated runways	253
Certificated air carrier airports with unscheduled service (includes charter operations)	273
Without towers	189
Without VASI's	111

Without ILS's	134
Without treated runways	253
Totals certificated air carrier airports	727
Without towers	371
Without VASI's	154
Without ILS's	222
Without treated runways	506

I would like to point out that many of the air carrier airports have more than one VASI, ILS and surface treated runway. Moreover, most of these airports also serve commuter airlines. We have recently gathered extensive information on the facilities available to commuter airlines and are currently in the process of correlating this data. I will be happy to forward additional data on commuter facilities upon completion of this analysis.

Sincerely,

CLARK H. ONSTAD, *Chief Counsel.*

The CHAIRMAN. Mr. Bond, let's go back to the line-oriented flight training program. This program was proposed over 8 years ago by the NTSB. Why is FAA only now working on a proposed rule to require this type of training?

Mr. HUETTNER. As I tried to explain, the problem, Mr. Chairman, is that we have not had the capability to present good-line oriented flight training in the past. We are speaking of capability of the equipment not being proper. So as we move——

The CHAIRMAN. Are you talking about advanced simulators now?

Mr. HUETTNER. That is correct. The older equipment was designed to do simply maneuvers, procedural training types of things. Now we are looking into environmental functions, a lot of different things, capabilities. Until we can have that capability we could not move into the LOFT with much more firmness, which is what we propose to do now.

The CHAIRMAN. Why was NTSB recommending that 8 years ago if the capability didn't exist?

Mr. HUETTNER. Sir, it is a matter of good simulation. If we have bad simulation of something, it is not going to be the most productive training. So our decision has been to move first into the area of improving the capability of a simulator, then into the area of looking at the training programs and modifying them to make the best use of the product that we have now to train with.

The CHAIRMAN. Do you have these types of advanced simulators now that are available to give all of this type of training?

Mr. HUETTNER. There are currently 86 simulators, 85, plus, simulators in the United States in air carrier operation. Of these, 12 have been approved for the landing maneuver which is phase 1 of the new training program.

Two additional are in the process. There are probably an additional 5 to 10 simulators which are capable of being upgraded to phase 2 in our new plan, to become what we might say advanced simulators. So we are really speaking of a transition over the next 5 years into much better simulation training throughout the entire industry.

The CHAIRMAN. Do pilots on different airlines get different amounts of advanced simulator training?

Mr. HUETTNER. The training programs are all approved by the FAA. There is variation between airlines, yes.

The CHAIRMAN. Why should there be a differentiation?

Mr. **Huettner**. We approve the training program based on programed hours of at least 20 hours of initial training, let's say. This is reduced based on the type of training devices and specific type of training program that is involved. So if one carrier has advanced simulators and better training equipment, the time can be reduced. We train to proficiency, is really the bottom line. To make a pilot efficient. Not a programed specific number of hours.

The **Chairman**. Since one can only realistically practice events like windsheer, blown tires on take-off, and faulty landing gear on final in an advanced simulator, why shouldn't all airline pilots be required by regulation to go through that kind of training rather than letting the airlines decide how sophisticated a simulator they want to buy and what their training program will be?

Mr. **Bond**. Let me try to answer that, Senator.

I think the answer is that there is a growing body of opinion in the industry that they ought to be required to do just that. The historical reason for the variety has been that the whole field of simulators has been developing and advancing very rapidly as Charlie Huettner has alluded to. There are only five or six now approved for the landing maneuver. But we intend to continue to urge air carriers to broaden the use of simulation. Since we have trained to a level of proficiency, in effect, what we have done is permit the carriers to adopt any approved technique to get to that point which could include flying around and around in an airplane, which is expensive, which wastes fuel, and from our point of view probably is not the best way to train, assuming that the pilot is in fact proficient fundamentally as a pilot. That no one can really realistically recreate the terrible flight emergencies in an airplane, the risk of crashing in training is just too high. But anything that you can imagine can be done in a simulator; its program can do that. So it really does have a better ability as you have pointed out to create emergencies. So we are moving in that direction.

The **Chairman**. In the preamble to the FAA's new advanced simulator rule, you state:

> By taking advantage of the developments in the state-of-the-art airplane simulators, flight crew training could be upgraded from a strictly maneuvers and procedures oriented program to a program where crew members could also gain experience with working with abnormal flight systems in environmental situations.

You go on to say:

> That your review of accidents indicates it is not the pilot's inability to fly a specific maneuver, but rather the failure of the crew to deal with the abnormal flight situations which cause accidents. Improving line oriented flight training in advanced simulators could be the most significant means for reducing these types of actions.

Again, that statement is part of an optional regulation. Why didn't you make advanced simulator training a requirement in your new rule as soon as enough simulator capacity is available?

Mr. **Bond**. We regard this as a step in that direction, Senator. It is the first regulation we put out on this subject. I guess it is possible for us to have made it mandatory. But this is a very strong incentive, I might add, because we have permitted as a trade-off for actual flight hours, of course. A lot of money can be saved in it as well. So we regard it as a progressive step. I can assure you if I have anything to do with it, and I may not, but if I do, if it proves out, we will very seriously consider making it mandatory in the years ahead.

The **Chairman**. The NTSB has told this committee that accurate, up-to-date weather reporting for pilots is an area that needs improvement and that weather is a factor in half of the human factor accidents over the past 5 years

What are we doing to keep pilots out of bad weather?

Mr. **Van Vuren**. Senator, as I mentioned before, we established the weather center service units in the air route traffic control centers. We have 18,000. The other Slb finished by the end of this year. In addition, last year or so we established an en route flight advisory service in the flight service stations. We have 44 of these now. We are right now in the process of, in June next year, starting installations of color weather radar in those 20 centers plus those 44 en route flight areas.

In addition, we are now going into some training program to deal with our weather coordinators. Normally, these are our flow controller positions. They work alongside the National Weather Service meteorologists we have in our control centers to give them some better type of training and set up some type of standard program for them to make sure that this weather is handed to the pilots.

Down the road we are looking, in fact, we are going to run an experiment at the Cleveland Air Route Traffic Control Center sometime next year with color weather radar. We are going to put that at different sectors throughout the center so the controller himself will see real time-life color radar.

The **Chairman**. Does that mean then that the controller would relay that information if he sees bad weather situations or a bad change?

Mr. **Bond**. Yes, Ray was talking about new programs we have just implemented. He is entirely correct.

Let me point out several more that already exist. Our primary radar that is in place in all of our radar sites reflects rain. And so precipitation concentrations are reflected on the radar we have that our controllers get. It is shown on the radar screen. So we can warn pilots of that weather.

In fact, I believe that was done in the case of the Air Wisconsin incident, just looking at the screen, though we did not apparently pass the SIGMET off, we gave the pilot a clear warning of weather. That is what we have now.

They also have onboard their own weather radar which shows ahead again precipitation concentrations, water. We have just certificated another kind of thunderstorm protection device called the storm scope which concentrates on picking up and shows to the pilot where electrical concentration, also characteristic of thunderstorm cells, that is also now an optional alternative use for air taxi 135 operators. They can use that weather.

Further down the road we are working with the National Weather Service on the development of the next radar system which will be a Doppler-type weather especially designed to give weather information. It will be far more sophisticated, will be able to be raised and lowered, the profile, of thunderstorms and cells, and will be designed specifically for the detection of weather itself.

The radars we have now are primarily designed for aircraft skin paint in space and secondarily they pick up weather.

The **Chairman**. Altitude deviations is another factor involved in past accidents, and in one quarter of 1976, over 80 altitude deviations were reported, resulting in seven narrow misses. Has the FAA ever pursued an enforcement or other program aimed at reinforcing the attention of pilots and controllers on altitude?

Mr. **Luffsey**. Yes, sir, we have pursued enforcement actions. In fact with special emphasis programs, have created careful surveillance of that particular deviation.

As you know, our en route inspectors observe for those kinds of deviations during normal en route inspections. Special emphasis programs are a means for us to emphasize any area that the data is showing needs special emphasis at a given time.

Mr. **Bond**. Senator, the occurrence of an event is one thing. I think it clearly indicates enforcement activity on our part and surveillance. We also feel obliged to look into the underlying causes of the incident as well. That is where our human factors program comes in play. We are holding in October a public meeting on the subject of human factors. We will review all the work we have done to date and we will at that meeting present our program for the future for the next steps in human factors. We have already discussed it with the many interested boards, several unions, manufacturers, the operators. We have gotten strong support, especially because we have been talking with the Airline Pilots Association, especially from them in this area.

We expect to bring in not only our own people at this human factors meetings in October, but also outside experts, NASA, Naval Research Lab, and other third parties that we think have no bias, to work on this problem. We expect to consider the possibility of conducting an evidentiary-type hearing in which the studies and parties to the work are subjected to cross-examination by the various interested groups in order to eliminate any possible bias that may occur in the studies on our own part. We want to make a good effort at everything all the interested groups are interested in and present it to criticism and comment.

The **Chairman**. Senator Kassebaum.

Senator **Kassebaum**. Mr. Chairman, I have several other questions but they are really both for Mr. Bond and Mr. Poli and I understand there may be a chance to address them both.

The **Chairman**. We will ask Mr. Bond to stand by after Mr. Poli comes forward. We may have some questions to the two of them at that time. With regard to the DC-9-80, why did you decide not to conduct the simulator test requested by ALPA?

Mr. **Bond**. There are two reasons, one technical and one regulatory. The structure of the regulation is worth noting. Our rules, ever since 1965, have permitted a manufacturer to present an aircraft to us with either two or three or whatever number of crew aboard. And not to test it in the alternative. That rule which has been in effect, in place, for 15 years is based on the excellent statistical safety record of aircraft with both two- and three-crew crew complements, a fact not disputed, I think, by any participant in this discussion.

So as a matter of rule, there is no obligation on the manufacturer to present with other than two, other than three if they choose to submit it with three. I would note a recent type certification took place with a new model of the Lockheed L-1011 long range and that was a two-man aircraft.

Simulators are really not available for full simulation of an aircraft until considerably past the time when it is certificated. It is essentially at present not possible, certainly has not been done, to create a simulator to simulate an aircraft which is still in the development phase. No one would know what to put in it. The aircraft is being changed from time to time. We do, however, conduct simulations of the aircraft through training procedures after the aircraft is certificated.

The CHAIRMAN. If ALPA were to file a petition to change the crew complement rule for all future transport aircraft, would FAA at that time grant a hearing so that cross-examination could take place?

Mr. BOND. I would think that the answer to that would be "Yes." You have put your finger on the issue, Senator, which is that the rule is where the determination on crew complement has been made, not in the procedure for this or any other particular airplane. I have encouraged the union to file against the rule, which I might add they have never done over the years. If that is done we intend to proceed in a fair and openminded way to evaluate the planes that the rule petition might make against our rule. I would certainly expect that a public hearing, if that petition is filed, would be held.

The CHAIRMAN. Would you agree to a simulator testing of future workloads on two-man and three-man crews in that process?

Mr. BOND. We intend to build that process into our human factors program, which will be announced on October 7 in greater detail. I think that it is a useful exercise indeed.

Mr. ONSTAD. Senator, from the regulatory standpoint, if I may, we certainly would entertain such a petition. But we have structured this human factors work force, task force meeting in October to, in effect, define the problem. It might be premature at this time to file a petition for rulemaking on crew complement given the fact we are trying to bring all the parties together in October. We envision that once that human task force takes place and we define a program, it's from there that you proceed to rulemaking. That is why earlier Mr. Bond alluded to the fact that in the context of the human factors task force we will hold an evidentiary-type hearing to deal with just the problem you are raising here but at an earlier stage before we proceed to rulemaking because there is still a number of parties that haven't been heard from, a lot of valuable input that needs to be made in the process before we are ready to go forward with rulemaking on the subject, sir.

The CHAIRMAN. I must say that debating this question on a rule seems to make more sense to me rather than fighting about it over every new airplane to be certificated. I believe two men can fly safely but I am also willing to test my belief in a simulator evaluation. I hope the FAA, manufacturers and ALPA will pursue this kind of factual debate on the crew complement and keep this issue from becoming a political public relations battle.

Now turning to controllers, would you describe for the committee the incidents in Atlanta and New York where controllers are believed to have put aircraft in dangerous weather in control situations?

Mr. BOND. Yes, sir. The situation in Miami, which is the one I believe you alluded to, the headquarters are in Atlanta. Briefly, the Miami incident was as follows: I would like to submit the actual transcript of the conversation between controller and crew for the record. Nevertheless what happened was by way of background, apparently Braniff Air Lines by reasons of training or some other reason had temporarily suspended its permission for controllers to ride within the jumpseat without charge on a familiarization ride. It had been signed, I believe, by a Mr. Brown.

As the Braniff airplane approached a Miami airport a controller asked if the jumpseat was full. The answer from the pilot who was baffled by the question said, "No, there is no one in it." Then the discussion was, "Well, you should tell Mr. Brown that he should look at this matter." Meanwhile the aircraft was suddenly vectored directly into the direction of a thunderstorm which was a threatening, life-threatening event. And then vectored away from it and a routine landing.

The pilot of the aircraft said, "Wow, you are putting us right in the stuff," that meaning the cell. We regarded that incident as an intolerable circumstance, and I hope following all of the civil service rules, terminated the employment of the controller. Not only for the benefits that would come from separating someone who would do that from the service but also as a message to anybody else who would get the idea later. That was the Miami incident.

The situation in New York involved the Aeroflot flight coming in during the dispute over Afghanistan and the participation in the Olympics and so on. As I again recall it, the aircraft during a switch from sector to sector suddenly disappeared from the scope of the controller and so was not picked up on the handoff to the next controller and was allowed to fly, therefore, at the wrong altitude and unrecognized into air space that was potentially occupied by another aircraft.

That matter is even more threatening from a life point of view. We moved the controller that we thought might be responsible for that from control of traffic. The U.S. attorney has the matter under investigation as a criminal issue; and has, I might add, declined to prosecute very recently.

We did a study of this matter to see what the likelihood was that the machine itself had lost the aircraft in the handoff from one sector to another. In other words, not a human cause, but that the machine lost the data in the transmission. And the risk analysis that we performed indicated that the risk was something like on the order of 1 billion to 1 to 10 billion to 1 that the machine had done it.

Based on that analysis, we felt pretty strongly that it had been done deliberately by one of our controllers. That matter was reinforced by the fact that literally the night before the incident happened there were statements made and notices put on the bulletin board of the facility in which it happened that they wouldn't handle the Russian airplane. So we believe it was probably done deliberately. I need not point out to the committee the hundreds and hundreds of human lives not only onboard the Russian aircraft, the Aeroflot aircraft, but onboard another American aircraft that might have been in the airspace if a midair collision had occurred.

The CHAIRMAN. In your opening statement, you referred to the slowdown in Chicago and you referred to it as a strike. Let me ask you, do you believe that a strike is planned by the PATCO for next March? And if you do, what indications do you have that suggest there is going to be?

Mr. BOND. Senator, I use the term strike as a legal word of art. Any withdrawal of services or work less than standard, or slowdown, or whatever, has been defined by Federal courts as being the equivalent of a strike, as a matter of Federal law.

Now, there is voluminous evidence that there is in process and under active planning by PATCO a nationwide air traffic controller strike to be arranged in 1981.

Our contract with the union expires in March 15, 1981. I believe it is quite clear that the controllers union is pointing to that event for a nationwide strike.

Here are the events that have led up to my conclusion that that is happening. First of all, the membership of the union, our controllers, have been circulated repeatedly with questionnaires asking whether they would support a strike. What would they do, what is their attitude toward it.

I don't know the data that has come back. Then a strike plan has been circulated from national headquarters of PATCO to all of the locals in the system. It is voluminous and detailed on what to do in case a strike should happen. How to get credit, how to delay the payment of bills, how to get food stamps out of the U.S. Government, even though all this is illegal, of course. It is quite complete. Coordinators for the strike, and so on. It is just complete.

We have filed that document, incidentally, before the Federal Labor Relations Authority and have requested it be declared an unfair labor practice.

To my astonishment, the FLRA has concluded on our petition that no cause of action exists to the Government because there has been no strike and, therefore, the preparations for this strike which would be illegal are irrelevant. I regard that as similar to passing out handguns or atomic bomb somehow, and then saying, well, there is nothing wrong with doing that, there hasn't been an explosion yet.

Yet another evidence of the preparation of a strike in 1981 is the strike fund. The national union here in Washington is collecting money, large, large sums of money from the membership, which is aimed at a strike in 1981. It will be used for tiding people through hard times and paying salaries and expenses associated with the strike.

I believe that since the strike is illegal, that the strike fund, therefore, must be in some way illegal, and the Labor Relations Authority does not support us on that.

So those are among the many traces leading up to the purposes of a strike in 1981.

Yet another incident happened. The founding president of the controllers union was overthrown in January of this year in what has been described by the press as a coup by another person who I believe it is fair to say has made more radical promises to the membership and been more ferocious in his statements. That is Bob Poli, who is now head of PATCO, and will appear before the committee quite soon, perhaps momentarily.

And there was no mistake among membership why that sudden unexpected change in leadership came about because of increased expectations for gain by the new president. Let me touch on what I believe to be the goals the leadership has announced to the membership of the union. I do not believe that the normal routine things that can legally be bargained for by a Federal employee union are afoot or at heart here: Shift changes, grievance procedures, and so on.

Those are legally bargainable for, and that process has been described by the union as collective begging. They don't like it. They think that they need more. And so I am convinced that what will be sought in 1981 by the controllers union is the right to strike.

No Federal union today has—executive branch union—has the right to strike. It is illegal. It is a crime. The offers of the union of affirmative action to deny and discourage any strike. They want the right to negotiate for wages also. No Federal union, executive branch, can negotiate for wages. The Congress sets wages. They set the pay levels through the GS scales which the controllers are under. They set annual bonus and retirement plans. The whole process is done congressionally, not in the collective bargaining process.

I believe also what is on the agenda is ultimately, in order to achieve the previous two, the union wants a Federal corporation set up similar to the post office that is outside of the executive branch of the Congress, outside of the executive branch, so that the right to strike and negotiate for wages can be achieved.

All of these things that I have described cannot be granted by me as a negotiator in the collective bargaining process and must be granted by the Congress. So it is clear to me that the 1981 strike is not necessarily aimed at me. I can't stop it. My frustration is that there is nothing that is really wanted in this process that I can grant.

The barrel of this gun is pointed directly at the Congress of the United States, and I believe the union is going to try to force the Congress to separate it from the executive branch, grant for the first time the right to strike, grant the right to negotiate for wages, and to do so at the point of a gun.

It is quite simple to me that the goal is nothing less than to bring the American economy to its knees through the cessation of all air traffic in the United States and through the exercise of raw power to force the achievement of those goals.

The **Chairman**. Would you make available to this committee the strike plan that you referred to?

Mr. **Bond**. I would be happy to do so, Senator. As a matter of fact, I believe we have it here.[1]

The **Chairman**. Assuming there is a strike next March, what is the FAA going to do to keep the system safe?

Mr. **Bond**. Senator, we have developed a series of contingency steps to meet this threat. One has already been implemented some time ago as a result of the 1978 slowdowns. It basically is a step-by-step incremental discipline procedure which is predictable in nature, which is minimal in nature and is always designed to encourage the controller to go back to work at full capacity.

That has already been in effect and predictability is the characteristic of the system. It would lead to dismissal, but also lesser degress of discipline. That is already in effect and I will give the committee a copy of that.[2]

More recently, as the strike threat became more apparent to us, we have developed a counterforce, counterplan to the strike itself. I will submit that to the committee also. We may even publish it in the Federal Register and request comments from the public on the strike plan that the FAA is likely to encounter. We would be interested in the comments of the airline pilots and public on how we best can deal with this threat.

Basically, our first strategy in the event of a strike will be to continue the military and defense service flights in the United States. We now have a common system. There is no independent military air traffic control system. Our first priority will be to continue the defense of the United States against possible foreign invaders in the event of a strike. That comes first.

Second, we will try to keep as much traffic going as we can with management personnel. By that, I mean our supervisors in the system. Those people are already qualified and certified as controllers in our system, and they will be working the boards as they do to a lesser degree today.

So we will keep as much service going as we can. We will hope that the majority of our employees will not conduct an illegal action. I am confident that the vast majority of them will not do so. We will use as many controllers who do not go out of work to continue the system along with our supervisors.

So we will do our best, we will be organized and prepared as best we can be to meet this challenge in 1981. But I think there is no point in fooling ourselves. Potential for damage to America is great.

Potential for disruption to the economy, disruption of the tourist industry, defense, business, is quite grave if this is really taking place.

The **Chairman**. Senator Exon.

Senator **Exon**. Thank you, Mr. Chairman.

Mr. Bond, in case of a strike, you must have contingency plans. Could you briefly review these? I imagine you would have to cut back the number of flights dramatically.

Mr. **Bond**. I would like to ask Ray Van Vuren; Ray has been coordinating this. Copies of all this have gone to the field. They are no secret. In fact, we would like to make them public. They will involve, incidentally, before I give it to Ray, hard questions on our part. For the first time we will really have to face the question of whether we should permit entry into the air traffic control system of a business aircraft with one or two people on board when the system is so strained as to capacity, that they will clearly have to leave an airliner on the ground.

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[1] The material referred to has been retained in the committee files.

[2] Ibid.

We don't have that kind of a crunch today, but it certainly could come up in the near future not to mention military service. That will come first anyway. Ray.

Mr. VAN VUREN. We are still finalizing some of the details. Right now we have looked at the national system, and also tying it in with—the follow-on will be the different regions will be involved and different facilities will be involved to dovetail their plans with the national operational contingency plan.

Basically, what it amounts to is air carrier-air taxi, and as Mr. Bond mentioned before, military would have first priority. The air carrier, air taxi, what we are looking for systemwide is flights of 500 miles or farther. That is our concern. We figure anything else less than that you can take ground transportation or other means to get wherever you want to go. But long-range flights are the problem areas.

You would end up having one-way routes. In other words, certain altitudes would be assigned to those routes so we wouldn't have any climbing or descending, no airborne delays or holds. It would be all controlled through a scheduling process and would go through with the air taxi and air carrier operators.

With probably the operation of the system as it is today, would only be about 15 percent of what we are operating today. That is the way we see it.

Senator EXON. Did I understand you to say that if we should face a crippling strike that you would not try and control flights of 500 miles or less?

Mr. VAN VUREN. It depends, as Mr. Bond mentioned, to what degree the strike was effective. In other words, if you have a lot of control towers out in certain areas, no, we would not. If we had some of the towers still operational, we would do tower en route. Primarily we are looking at the high altitude long-range stuff. Our concern is the air traffic control centers. If they are out of business, we are in trouble and the only way we can operate there is with minimum staffing, the supervisory work force we would have. Then it would be different sectors we would be operating with and different airways we would require the air carriers to fly on.

Mr. BOND. Senator, I think your concern may have been a little different from that. Your concern was, would we let them go unsafely perhaps? The answer to that is "No." What we are talking about is a question of access to the system. If they can't get into the system, they wouldn't fly.

Senator EXON. Yes, that was the thrust of my question. Do you have authority now in case of a crippling strike to order United Air Lines, for example, to cut their scheduling in half.

Mr. BOND. We have no specific authority to address a question posed like that. But if the system does not have the capacity to accept them, the air traffic control system will accept and watch the flight. So they will just sit on the ground. I think clearly we must quickly address the question of priorities and access to this ystem in the case of a strike.

Senator Exon. Do you have a work force or task force in your lepartment working with the airlines at this time on the problem vith regard to my question?

Mr. Bond. Yes, we have had a number of discussions with the irlines. But it is my view that that isn't enough. We have business isers of the system, commuter users, and military users of the ystem, so the discussions will broaden to all users of the systems. But we have first been talking to the airlines.

Senator Exon. Do you have a plan in effect now with regard to he degree of the strike as to how many, I realize there are commercial and private and all this, but do you have a plan in effect ight now that United Air Lines, for example, or American Airlines or TWA would be forced to reduce and make the choice in advance of the number of flights that they would cancel, or curtail, r delay?

Mr. Bond. We have no such plan of that sort in place yet. Our vork hopefully would lead to a decision at that time.

Senator Exon. Don't you think that would be a good idea? The uicker we get something like that in place, you might take some f the fangs out of the possible strike that you have referred to in estimony?

Mr. Bond. Yes, we would think that the best, absolutely. We ntend to get to that point as quickly as we can. If there is no legal tructure for us to make that decision, I would quickly hope that he air carriers themselves would make that decision among themselves perhaps with a CAB community grant on hand. But somebody has to do it.

Senator Exon. Do you need, Mr. Bond, any legislation in this rea, or do you think we have legislation in place to give you the egal authorities that you need?

Mr. Bond. The legal authority in regard to illegal actions——

Senator Exon. I am not talking about that. You have explained hat. Evidently so far, the threat of civil or criminal action has not lissuaded the union from taking part in what might be illegal ctivity. I am saying, do you have the authority to order all types f aircraft to remain on the ground?

Mr. Bond. For safety reasons, yes. We can certainly order aircraft so long as it is done in a nondiscriminatory way, I would hink, not to fly because there is no way we can accept them into he system. But we do not have the authority to start allocating hat amongst air carriers. In fact, the law is quite clear. First ome, first served. Everybody has a right to nondiscriminatory ntry into our system.

Senator Exon. That is the free enterprise system at work.

Mr. Bond. I endorse it. It just didn't have this kind of thing in nind when it was laid out. We are somewhat puzzled as to how to ass out the bad news.

Senator Exon. I am somewhat puzzled that you are going to have reat difficulty in that area. Have you, I ask you again, do you hink you need any additional legislation to strengthen your hand n case of strike that would require passage of legislation by the ongress?

Mr. Bond. At the moment we haven't asked for it, Senator, because we don't think that there is necessarily going to be a safety threat. We can clearly constrain entry into our system in a way that will keep the system safe. It is at heart a question of capacity of the system. I would like to ask Clark Onstad, our Chief Counsel, to ask about criminal position on penalties. That is a separate legal matter and we have found lately it does not exist as well as it might.

Mr. Onstad. Senator, there is in the case of the situation in New York, to address that situation first, we found there is no criminal penalty for an individual to purposely and deliberately vector an aircraft into an area in which it should not be. For example, to block the data block on the Aeroflot flight last January, in fact, the U.S. attorney in New York recommended we seek legislation to make such an activity a criminal activity. There is no specific criminal statute to vector purposely an aircraft toward a thunderstorm because you want a jumpseat.

To come back to the question of allocating resources in the air space, the answer is that we do not have the authority to decide that United Airlines gets three flights and American Airlines gets two flights under a situation such as this.

What has happened in the past with our central flow control facility is that we have had great cooperation between the air carriers and the FAA in trying to figure how do we allocate the resources we have on a night when there are thunderstorms in the Midwest, something of this nature. If we get down to a crunch where we have to make the decision, air carriers fly, commuters don't, something like that, that is going to have to be under current legal authority a day-by-day decision, an operational decision. We do not have specific statutory authority to deal with that kind of problem, sir.

Senator Exon. If I understand your responses, you are not sure any more legislation is necessary in that particular area?

Mr. Onstad. The reason I make that point, sir, because under 307-A and C of the Federal Aviation Act, we have the authority from Congress to decide, to, in effect, utilize the air space in a safe and efficient manner. What we are really saying is that we would have to use that authority, 307-A and C, to decide what is safe and efficient. That would have to be FAA's management decision.

Now that doesn't get down to the question of, is it business aircraft or commercial aircraft. That is just something we would have to assume that we had that authority under 307-A and C.

Senator Exon. Do you need any more legislation in the area, it's already against the law to strike, you have criminal prosecution for that. I assume no more legislation is needed in that area?

Mr. Onstad. Sir, I think that no more legislation is needed. But what is needed, sir, and what is very important here, is for the parties involved to understand the intent of Congress. There has never been a criminal prosecution under the Federal antistrike laws. In fact, when I was dealing with Mr. Phil Hyman, head of the criminal division in 1978 after the controllers slowed down, they slowed down because they wanted free rides to Europe in the jumpseats, he advised me there had never been a criminal prosecution.

It's my hope in dealing with the Justice Department, in dealing with these kind of situations in the Federal courts, that we would have an expression of the Congress that the Congress doesn't intend to have the air traffic controllers slowdown or strike. That would be a very useful tool in dealing with this kind of situation, sir.

Senator EXON. Have you supplied any suggested sense of the Congress resolution to any Member of Congress?

Mr. ONSTAD. No, sir, we have not.

Senator EXON. Would you be good enough to supply that to me? I would like very much to look at it.

Mr. ONSTAD. Certainly, sir.

Mr. BOND. I wanted to add one thing. We have a book here we would like to copy and submit to the committee also. Basically this is a compilation of many, many documents circulated through our system here on the subject of the strike. Let me quote an edition of the Southern Flyer. Developing—Developing within the country where workers are having classic battles with their employers regardless of whether the confrontations are legal or illegal strikes. That vein is carried on throughout here, so there is a clear pattern of conspiracy, I believe, developing. What are they wanting ultimately, not just right to strike but also money. It is—the controlers' union feel they should be paid as much as pilots work and should work as much as airline pilots work. I would myself like to be in that category and I am not.

The most recent contract, I believed, signed——

Senator EXON. I would, too. I am not qualified.

Mr. BOND. Well, I am confident that with time the Senator could and in many cases is a very highly qualified pilot. The best contract now signed from the pilots would pay $140,000 per year for 80 or 60 hours a month, the equivalent of 12 to 16 days of work a month. That is what the public employees, our controllers, want. That would put them more than twice what a Senator or Congressman makes. Or I.

Senator EXON. Let's get back to this vectoring matter. Not too many weeks ago I read a story in the newspaper that in some lowdown area, I believe it was a commercial airliner was intenionally vectored into a thunderstorm. If I remember it right, the pilot noticed this and made some comment to the tower and the word came back quite clearly along the lines of, well, now you will ee how important we are, or something to that effect.

Mr. BOND. Your memory is correct. That happened in the Miami area. We have since fired the controller. He is on appeal. We have a copy of the transcript here and will submit it to the committee or your consideration.[3] Did not vector the aircraft into a thundertorm, in the direction of a thunderstorm. So ultimately the trigger was not pulled. But the pilot and I are both worried about that.

Senator EXON. If I understood your testimony, you said that we do not have a law making that a criminal activity.

Mr. BOND. That is correct, Senator.

Senator EXON. In your opinion, should we have a law that makes hat criminal? It seems to me we should.

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[3] The material referred to has been retained in the committee files.

Mr. ONSTAD. Based on my experience with the U.S. attorney in New York, and I have had a number of hours of dealing with this problem, and in my consideration of the Miami matter, I would strongly recommend we do have a Federal law. This is a Federal air traffic control system. We need a Federal statute to deal with this kind of problem, sir.

Senator EXON. Have you suggested that to Congress?

Mr. ONSTAD. We have not yet, sir. We have been so busy dealing with the matters we haven't had a chance to do it.

Senator EXON. It doesn't take very long for a lawyer to draw a bill.

Mr. BOND. No, but clearing any bill through the bureaucracy of the executive branch is beyond a lawyer's skill.

Senator EXON. I did not ask you to clear it through the executive branch. I merely suggested if you can't draw one, maybe we can.

I would very much appreciate your suggestion in that area because I think this whole matter of air traffic safety, I know a lot of people work very hard on, a great number of people are uptight. We generally get uptight about it after there is a major catastrophe somewhere. I suspect probably that the average air traveling public today does not know the—certainly not the intricacies of the system.

But the fact that if you have anybody in a tower, labor unions or no, that doesn't recognize and realize that vectoring an airplane toward a thunderstorm is a sign of a spreading cancer on philosophy that I think must be corrected.

I hope, and I believe that the Congress likely will stand very strong and firm against whatever we can do here to avert an airline strike. This is one Senator, at least, who would be glad to stand to be counted on such things as that. I don't believe that we dare give any union, regardless of how well intended they are, the power that you have indicated, Mr. Bond, this union would like to have.

On another matter before I am taking too much time, Mr. Chairman, there is a question I would like to get into that was referenced to in your prepared testimony, Mr. Bond, regarding medical problems of pilots. How well do you think the agency is performing in this particular area right now? Are you satisfied with it?

Mr. BOND. No, I am not. I am never satisfied with the performance of our agency in any matter. Experience has taught us that as time goes by, we always get better at it as we learn more about it. In any case, the medical area is one of the most difficult ones because it again involves predictive judgments about how people will perform in the future. It is very controversial.

Our judgments are appealed. They make terrible—they have terrible consequences on the folks whose certificates are lifted as a medical matter. It is a very difficult area.

Senator EXON. I have a file that I would like to give you, Mr. Bond, on one of my constituents that I don't care to pursue this questioning a great deal at this time. But here is a man who has had some medical problems. According to all the information I have received, and I have been checking into this, the medical problems were cured. Doctors gave him a clean bill of health. But he was not recertified by your agency.

It seems that the flight certifying surgeon, or whatever he is called, took more or less of a closed attitude with regard to this particular individual. He was not and has not been recertified.

From reading this information I have gotten the impression that the surgeon, certifying surgeon in this area did not even request the ideas, the attitudes of the physician who was treating this airman, nor was he particularly interested in the hospital records as to what did and did not happen.

Because of the difficulties that he had had it seemed more or less an open and shut case that this particular pilot was not recertified. I have no way of knowing whether he should have been recertified or not, but that is why I asked you the question about the process.

In other words, not only do we have to recognize that we have to pass laws and do what is good for the most, but we certainly have the interests of the people at heart, I think. I hope that your agency would probably read this, you and your associates, look into this and give me a report on it, if you would.

Mr. Bond. I would be happy to, Senator, and I would also thank you on behalf of the FAA and all the aviation community, along with Senator Cannon, for all the help you gave us before the budget committee on restoring our safety money which was suddenly excised while no one was looking. We all recognize your contribution to that.

Senator Exon. Thank you.

Thank you, Mr. Chairman.

The Chairman. Mr. Bond, PATCO will testify that in the past 5 years, the workload handled by controllers has increased, based on FAA's own figures which include efficiency gains from automation. Has the controllers' workload increased and are we understaffed in the system or in some areas?

Mr. Bond. Well, our productivity of our controllers has increased in the last 5 years approximately 30 percent. I am proud of that record as our employees have good reason to be proud of that record as well. I am accused of trying to impress the Congress with the lean and clean look of the FAA. Of that charge, I am guilty.

Some of our specific facilities, O'Hare tower being one, are below the staffing standards that we would like to see. And therefore, as a result, the folks who are there have to work overtime in order to provide full service. So there is more overtime done in some towers than are understaffed.

The reason in that case is that primarily the attrition rate out of the tower either for promotion from supervisors because these are the best controllers around, very good indeed, or they end up in sunbelt cities and don't want to stay in Chicago because of the weather; but for a variety of reasons a few towers like O'Hare are understaffed.

Overall, there is clearly no understaffing in our system. The average controller per year in our system performs about 25 or 30 hours of overtime. That is 3 days a year, I guess, of overtime.

Since, as all of you who are familiar with management know, it is absolutely impossible and probably undesirable to staff to meet the highest peak in a system—if you have enough people to meet completely the greatest daily rush or seasonal rush, then not only would it be cost ineffective to stay at that level, but also you would have folks idle and clearly underemployed the rest of the year, which is another problem. So we do our best to staff 90 percent of the peak load, then to employ overtime beyond that.

Overall we have increased our productivity. Controllers—incidentally, it is at a time when productivity is becoming well realized as a national goal. The FAA has performed in many respects better than most American industries in productivity because we have improved 30 percent in 5 years. We are very proud of that fact.

At no risk, repeat, no risk to safety. There isn't a shred of evidence in our system that the staffing or work levels have caused any derogation of safety in our system. We check it constantly because we are worried about that.

The **Chairman**. What is your response to the PATCO claims that controllers have a longer work week than several western nations and that too much overtime is required? You have explained why you have to have some overtime, but how do you balance that out?

Mr. **Bond**. First of all, the work week for all Federal employees is set by the Congress. We do not believe that the FAA can throw it away. That is also incidentally one of the things they would like to achieve with the strike in 1981. Less than 40-hour work week. We believe the Congress has set it, and we don't intend to deviate from it.

The average controller is actually controlling traffic, however, about 5 hours a day. The rest of the time there is either a lunch break or rest period or training or something else going on in there, so that the activity of our controllers is maybe 5 hours on average per day, something like that. So productively 25 hours is what he puts in. Of course, the other part is work also. Training and so on is work.

Nevertheless, that is the amount of time on station. Now further deducted for that is obviously the fact that most of the time, or a very substantial portion of the time the traffic is not heavy. There are controllers controlling traffic at our facilities at midnight and 2 a.m., and there aren't very many aircraft in our system, so the work is not heavy then.

When you put all the factors together, Senator, there is no doubt in my mind that our people are worked at a fair pace, but not an excessive pace. Again there is no evidence of mental health problems or medical problems anywhere in the system.

The question of whether overtime required is too much or too little is a little hard to address, other than relatively. Since 25 or 30 hours, 2 or 3 days, 3 or 4 days per year is the amount of overtime we require of our folks, it seems to me it is not too much. I don't think anyone can look at the numbers and say overall that there is too much overtime required. In some specific facilities, however, the O'Hare tower is one, there are special cases. We have a terrible time attracting people into the O'Hare tower. But we have just announced last week a new program for bringing more folks into the Chicago O'Hare tower. It's part of our struggle to keep folks working outside of the strike circumstance.

The **Chairman**. PATCO believes the increase in system errors you note in your statement is due to a combination of too much overtime and too many computer failures. What is your response to that?

Mr. **Bond**. There is absolutely no evidence of that. Every one of our system errors is analyzed by a system error review board. And I don't believe we have yet found a case where the staffing level was responsible for that. Especially true, Senator, is the fact that a very large, surprisingly large number of the system errors that occur happen at very slack periods of time, just after traffic has gone down from a peak, for example, where attention wanders and people are not concentrating on their work, and they say separation goes to 2 miles, when it ought to be 3. That is a system error as properly described.

So we can't find any connection at all to hard work. We found the evidence, for example, at O'Hare and other busy airports indicates to us that when controllers are really working at full capacity and concentration is high, they do an excellent job of controlling traffic.

The **Chairman**. You didn't relate to the computer failures, computer errors. How does this relate?

Mr. **Bond**. Well, we—computer failure is a problem we must address in our system. We are addressing it. It is getting better in the sense of the likelihood of computer failure is getting less. All of our reliability statistics indicate we are doing better at it. We have backup systems, alternative radar systems available at the touch of a button which will provide an alternative system to the computerized display. That we believe can operate safely. We have one problem in our system and that is the transition training. It has become clear to us that the generation of controllers who used the old style radar, broadband radar, many of them have retired. Many of our newer controllers have come into the system and are not familiar with moving traffic on broadband radar and do not have much experience at it. So the transition training from one to another has not been adequate in the FAA.

We now have a program going that will upgrade the training of folks, so they will be able to move quickly and gracefully from one system to another, in the event of computer outage, which clearly can happen at any time.

We have a strategy for it, we have always had one. But it probably wasn't good enough, because of lack of training on it. So we are trying to address that system as best we can. I might point out, finally, that we had a period of about 10 days at the O'Hare Airport, when our new computer—even better and safer computer system—had a shakedown difficulty there. During that period of time we reverted to the old broadband radar for the most busy airport in the world. During that period of time we safely and without delay, moved the largest number of aircraft that we have all year at O'Hare Airport. It was a great accomplishment by the controllers and really illustrates that both systems are safe.

The **Chairman**. In ALPA's testimony tomorrow, they will question why FAA has not issued an NPRM on cockpit-installed windshear detectors tested by the FAA some years ago. Can you tell us the status of that program?

Mr. **Bond**. Walt Luffsey might.

Mr. **Luffsey**. Windshear is a very complicated subject, sir. We are in the process currently of evaluating windshear detection devices aboard aircraft. Our 727's are equipped with several different devices. As an interim measure, we issued advisory circulars to provide information to the pilots, so there will be better available information and operation in a windshear condition.

The **Chairman**. ALPA will also suggest that controllers be required to give pilots information about severe weather conditions. Considering the fact that FAA, controllers and pilots, have all been getting along so well lately, I think you ought to be able to work that out.

One further question on advanced simulator training. You have stated in your own NPRM that that LOFT plus advanced simulators are the best means of reducing pilot errors, which we have seen cause accidents. The NTSB made six recommendations back in the period of 1970 to 1973 on better crew management training and more simulator training of emergency conditions. There seems to be no controversy that this type of training would help reduce accidents, yet FAA continues to leave this up to the carriers' discretion.

Don't you see some inconsistency in your statements about this matter?

Mr. **Bond**. Senator, I am not—are you familiar with that particular recommendation?

Mr. **Luffsey**. No, sir, I am not.

Mr. **Bond**. We will let Charlie address that.

Mr. **Huettner**. Their recommendation was in crew training, pilot and command assertiveness, things of this nature. Most airlines have gone independently into these types of training. The problem has been a vehicle in which to conduct the training. That is where the LOFT training programs which we have in the administrative statement this morning announced that we are going to proceed. So while there has been part of ground training, part of the ground school, management training opportunities, we are now moving into an area where we can actually assess and correct malfunctions through the LOFT programs.

The **Chairman**. Well, we have incidents, accidents where pilot training, lack of training, was cited, one at Pensacola in 1978, Eastern at Raleigh in 1975, Pan American at Pago Pago in 1974. In other words, they are pointing out that here is a related area that we ought to have more training in some of these en route training situations, or en route real-life situations.

Mr. **Bond**. Well, there has been an enormous preoccupation, what with the San Diego and Chicago crashes, with air traffic control contributions to the system which is important, and to the design and engineering of aircraft, that is to say, certification. In both crashes, in the end, the Safety Board found human failure caused the accident, failure to fix the system, and there was not a certification problem in the DC-10, the Board said. Similarly, in the San Diego crash.

I guess in my statements I have tried to emphasize the human contribution to all this has been drawn out somewhat in the preoccupation with other matters. I fully agree with the notion that somehow we find frequently gross human error and compound human error to be at the bottom of the most important cause of accidents in our system. Equally, it is the hardest to cure. If you look at the accidents you alluded to there, for example, you often find it isn't a question of necessarily bad manipulative training, but that it is ignored. Discipline breaks down. Or people are talking about politics or used cars, or that a third member of the cockpit reaches up and turns off the device that tells the crew they are about to fly into the water, and seconds later they fly into the water.

I don't know other than to emphasize line-oriented flight training and to check on what happens during the real phases of flight, which is what our cockpit recorder proposal will do, I don't know exactly how to address that. But we intended to pursue every avenue to find the cause. We are going to do our best. It isn't as simple technically as designing a jet engine that won't fail or a wing that won't fracture. This does not have quite the same technically obvious cure.

The CHAIRMAN. I may say that we agree with the direction in which you are going. But the question arises as to whether we are going fast enough in that direction. I think that line-oriented flight training has one of the best opportunities in this particular matter.

Mr. BOND. We have gone fast enough in that direction, Senator. I think the agency and industry have pursued what I call the simplest and most easily solvable solutions to safety and have not addressed sufficiently the very difficulty and intangible underlying problems with the performance of people in our system.

They are also, I might add, complicated, clearly complicated by partisan interests. Quite understandably, representatives of each of the folks who work in this system put on strong and vigorous and frequently credible defense in their behalf, but that becomes an obstacle. We have to be tough enough and our resolve strong enough to overcome it.

The CHAIRMAN. Any more questions, Senator?

Thank you very much, Mr. Bond.

If you will stand by so we may have you up after Mr. Poli testifies. We may have some questions directed to the two of you at that time.

Next we will hear from Mr. Robert Poli, president, Professional Air Traffic Controllers Organization.

STATEMENT OF ROBERT E. POLI, PRESIDENT, PROFESSIONAL AIR TRAFFIC CONTROLLERS ORGANIZATION; ACCOMPANIED BY MICHAEL SIMONS

Mr. POLI. Senator Cannon, I have a number of statistics and facts I have put into my statement for the record. However, I will capsulize it.

I believe your committee has a number of questions you would like to ask me.

The CHAIRMAN. We will make your entire statement a part of the record. You may summarize from it as you see fit.

Mr. POLI. Thank you, Senator.

Good morning, Senator Cannon and members of the subcommittee.

I am Robert E. Poli, president of the Professional Air Traffic Controllers Organization.

With me today is Mr. Michael Simons.

On behalf of this country's 17,000 professional air traffic controllers, I appreciate the opportunity to appear before you today concerning air safety and the role of the human factor in aircraft accident prevention.

We will address ourselves to some of the issues involving the human element which are directly related to safety in the skies.

PATCO has had the pleasure of testifying before you and the subcommittee on a number of occasions over the past few years. Our membership appreciates your continuing interest in the air traffic control profession and your concern for the well-being of those we all strive to serve—the flying public.

It should be stated at the outset that the U.S. air transportation system is one that every one of us in this room—the people who make that system work—can be proud of.

A passenger airliner takes off or lands somewhere in the United States on the average of every 3 seconds, around the clock, every day of the year.

In 1979, 318 million passengers flew a total of 256 billion miles—some 1 million times the distance to the Moon.

The number of passengers carried by domestic airlines has risen 75 percent in the past decade. Virtually every one of those flights was guided from takeoff to landing by highly qualified air traffic controllers and pilots.

Yet, this record should not be interpreted as a commendation of the Federal Aviation Administration. That organization is charged by law with maintaining rules for the use of airspace and the operation of the air traffic control system.

The airspace system functions as well as it does much more despite FAA than because of it. The present state of the system allows no room for complacency and much room for improvement.

PATCO believes that a critical problem in air traffic control today is air traffic controller staffing.

Let me try to shed some light on the situation from the controllers' perspective. Controllers are experiencing productivity demands that are unequaled anywhere in our economy.

In 1974, air traffic controllers handled 22.9 million en route operations at the various control centers. At the terminal facilities, controllers handled 24.1 million instrument operations.

By 1979, the en route operations had grown to 29.9 million and the terminal operations jumped to 36.2 million. This represents a 6-year increase of 31 percent for en route operations and 50 percent for terminal operations.

What has the FAA done to cope with this very substantial traffic increase?

One would naturally assume that it has increased the number of controllers and updated air traffic control equipment to the extent technologically feasible. Amazingly, this has not taken place.

Using FAA's own numbers, the increased traffic greatly exceed efficiency gains due to automation. In 1979, we believe en route centers were understaffed by more than 1,500 controllers, while terminals were understaffed by more than 2,500.

Yet, FAA has requested funding for only 412 new air traffic controllers for the next fiscal year. They claim to account for the difference by imposing a new staffing standard; that standard does nothing but give the status quo an air of legitimacy. The numbers do not make any sense.

The FAA has chosen to deal with the increased air traffic in a rather curious manner. On the one hand, they simply ignore the problem, thereby trying to deny its existence. On the other hand, they try to make the existing controller workforce put in vast amounts of overtime, a choice which shortchanges safety.

The problems inherent with overtime are obvious. The longer a controller works, the less alert he or she can be to respond to the air traffic situations that will arise.

The FAA uses this reasoning to restrict airline pilots to 80 hours of flying per month. Yet, a pilot is responsible for the safety of several hundred lives; while, at any one time, a controller at a major facility is responsible for as many as 2,000 lives.

Of more concern than excess overtime is the fact that many facilities are operating far below even FAA's revised authorized staffing levels. A review of actual employment figures continuously turns up situations where facilities are operating with less than the number of authorized controllers.

To get a more accurate picture of the situation, we asked FAA to provide us with a definition of a "critically staffed" facility and to delineate any facilities that were in this category at any time during fiscal year 1979.

FAA headquarters replied that they do not maintain such data and suggested that we check with each of their 11 regions. Ten regions responded. They all reported that there were no published criteria for designating a facility critically staffed.

The response from FAA's southwest region is particularly informative. They wrote us on March 7, 1980, as follows: "We do not maintain a criteria for declaring a facility critically staffed." They did not list any facilities as being critically staffed at that time.

Yet, just 2 days earlier, the region wrote a letter to the chief of the Plainview, Tex., airport traffic control tower, stating, in part:

> We define critical staffing as continuing to provide all required services using all operationally qualified personnel including supervisors and staff with no reduction in services and no increase in the use of overtime.

Either we have a case of patent mismanagement in which the right hand does not know what the left is doing, or else the FAA has not dealt honestly in executing its obligations to the public under the Freedom of Information Act.

The most frightening aspect of understaffing is increased chance for errors in aircraft handling. Between 1974 and 1978, "system errors"—accidents that could have, but did not, happen—increased 68.5 percent.

Another result of understaffing is a shortened work life for air traffic controllers.

The cost of adequately staffing FAA facilities pales in comparison to the costs of training replacements for controllers that have their work life unnecessarily cut short.

While adequate staffing is an essential element of the human factors aspect of air safety, so is adequate equipment. It is axiomatic that a controller cannot perform with maximum safety and efficiency unless he has sufficient, reliable equipment to work with.

PATCO has testified a number of times in the past year before various House subcommittees regarding the alarming failure rates of FAA air traffic control computers. These complex machines form the backbone of en route air traffic control and are located in each of the 20 domestic Air Route Traffic Control Centers.

The situation has not improved significantly, despite the publicity focused upon it. Controllers are frustrated by the system which mandates their acccepting responsibility for air traffic separation, while being required to use equipment which is susceptible to failure in vital situations.

The ultimate fear associated with an unplanned computer outage is that two airplanes in a controller's airspace will have a midair collision. It is a tribute to the air traffic controller's skill and dedication that an accident has never happened under these circumstances.

There have been, not surprisingly, a number of occasions on which there has been a loss of required separation between aircraft during, or immediately following, a computer failure. Such situations are referred to, in the FAA's parlance, as system errors.

Within the past year, PATCO has received nearly a dozen such reports. In each, there had been a failure of the required separation between planes during a computer outage. Many involved passenger-carrying jet aircraft. In each instance, the nonfunctioning computer was a direct, or contributing, cause.

Taylor of the FAA has also asserted that there existed a comprehensive radar qualification training program. However, PATCO has been able to establish that there has been an appalling lack of controller training in the use of noncomputerized radar.

Only now, nearly a year after PATCO first brought this problem to public light, has the agency begun to institute a thorough refresher training course on the backup radar system.

The FAA must bear full responsibility for the lack of reliable computers and adequate backup systems, as well as the incredible foot dragging in the implementation of an adequate training program.

The FAA maintains that it is not planning to replace the current generation of air traffic control computers until 1990 and will not even solicit bids for the design of new equipment until 1985.

PATCO fervently believes that planning for a new generation of air traffic control computers should begin today.

In furtherance of that goal, and on behalf of the millions of passengers using the system, we urge Congress to mandate immediate action. This subcommittee should hold FAA and Administrator Bond fully responsible should a midair collision occur as a result of a computer failure.

The appalling status of the en route computers is only the most recent manifestation of the FAA's unwillingness, or inability, to engage in realistic long-range planning activities. Historically, the most significant improvements to the National Airspace System have come in the wake of, and not before, a disastrous event.

While the FAA's response is best characterized as one of inaction, the Aviation trust fund continues to grow dramatically. At the present time, it has assets in excess of $5 billion, the huge majority of which is uncommittted surplus.

By contrast, the FAA generally spends less than a third of a million dollars annually on facilities and equipment, claiming that is all it needs.

PATCO strongly urges this subcommittee to mandate FAA to use a vastly greater portion of the assets now available in the trust fund for the purpose for which the Fund was created—namely, the purchase of modern, reliable equipment for the National Airspace System.

And, we believe that a top priority project would be immediate initiation of an accelerated program aimed at replacing the en route air traffic control computers well ahead of 1990.

Before closing, I would like to call this subcommittee's attention to one other area associated with the recognition of the human factor in air traffic control. In 1972, Congress passed the Air Traffic Controller Second Career and Retirement Act. This law provides eligible controllers the opportunity for an earlier than normal retirement and up to 2 years of federally supported academic or on-the-job training at full salary.

However, in approving the fiscal year 1979 budget for FAA, Congress voted no line item funds for a continued second career program. With that, the FAA barred any new entrants and the program was effectively halted.

FAA argues as if it were a negative attribute that the availability of second career training would have induced additional controllers to seek disqualification. Yet, this was the precise purpose of second career training. It was intended to discourage controllers from hiding their deficiencies. It was designed to give them assurances that they would have bona fide opportunities to obtain meaningful and rewarding alternative employment which would provide adequate income.

The data conclusively demonstrates that with loss of second career training, controllers are reluctant to step forward and this ultimately, and perhaps very quickly, will be detrimental to the safety of the air traffic system.

In closing, Mr. Chairman, PATCO requests that this subcommittee and the Congress mandate FAA to provide air traffic controller staffing commensurate with the increased amount of aircraft in the system and the unique needs of the controller to retain proficiency; that this subcommittee direct FAA to implement planning for a new generation of air traffic control computers at once, rather than waiting until 1985; that the Congress free the Aviation Trust Fund from the budgetary stranglehold now placed upon it, and that the moneys be used in projects for the enhancement of air safety; and that this Congress, in the interest of air safety, take action to restore funding for the second career program.

PATCO commends this subcommittee and you, Senator Cannon, for your sustained interest in the well-being of air traffic controllers and of the flying public.

Again, we appreciate the opportunity you have afforded us to testify here today on these issues of vital importance to air safety.

Mr. POLI. I will be glad to answer any questions that you have, sir.

[The statement follows:]

STATEMENT OF ROBERT E. POLI, PRESIDENT, PROFESSIONAL AIR TRAFFIC CONTROLLERS ORGANIZATION

Good morning, Senator Cannon and members of the Subcommittee. I am Robert E. Poli, President of the Professional Air Traffic Controllers Organization. On behalf of this country's 17,000 professional air traffic controllers, I appreciate the opportunity to appear before you today concerning air safety and the role of the human factor in aircraft accident prevention. We will address ourselves to some of these issues involving the human element which are directly related to safety in the skies.

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PATCO believes that a critical problem in air traffic control today is air traffic controller staffing.

Let me try to shed some light on the situation from the controllers' perspective. Controllers are experiencing productivity demands that are unequaled anywhere in our economy. In 1974, air traffic controllers handled 22.9 million "enroute operations" from the various control centers. At the terminal facilities, controllers handled 24.1 million "instrument operations". By 1979, the enroute operations had grown to 29.9 million and the terminal operations jumped to 36.2 million. This represents a 6-year increase of over 31 percent for enroute operations and 50 percent for terminal operations.

What has the FAA done to cope with this very substantial traffic increase? One would naturally assume that it has increased the number of controllers, and updated air traffic control equipment to the extent technologically feasible. Amazingly, this has not taken place.

In 1974, 22.9 million enroute operations were handled by 8,347 controllers, for an average of 2,743.5 operations per controller. In fiscal year 1979, 29.9 million enroute operations were handled by fewer controllers: 8,163. This computes to an average of 3,663 operations per controller—an increase of 33.5 percent.

In the towers, 8,234 controllers handled 24.1 million instrument operations in 1974—an average of 2,926.9 each. In 1979, 8,852 controllers handled 36.2 million instrument operations. This is an average of 4,089.5 each, an increase in per controller responsibilities of over 39 percent.

Using FAA's own numbers, the increased traffic greatly exceeded efficiency gains due to automation. In 1979, we believe enroute centers were understaffed by more than 1,500 controllers, while terminals were understaffed by more than 2,500. Yet, FAA has requested funding for only 412 new air traffic controllers for the next fiscal year. They claim to account for the difference by imposing a new staffing standard; that standard does nothing but give the status quo an air of legitimacy. The numbers simply do not make any sense.

The FAA has chosen to deal with the increased air traffic in a rather curious manner. On the one hand, they simply ignore the problem, thereby trying to deny its existence. On the other hand, they try to make the existing controller work force put in vast amounts of overtime, a choice which most greatly shortchanges safety.

The problems inherent with overtime are obvious. The longer a controller works, the less alert he or she can be to respond to the air traffic situations that will arise. The FAA uses this reasoning to restrict airline pilots to 80 hours of flying per month. Yet, a pilot is responsible for the safety of several hundred lives, while, at any one time, a controller at a major facility is responsible for as many as 2,000 lives.

Most Western nations restrict controllers to less than 40 hours working hours per week. For instance, the scheduled controller work week is 29 hours for Euro-

Control; 34 hours for Canada, 36 hours for Denmark; 37.5 hours for Belgium; and 38 hours for Switzerland.

A year ago, FAA told the Congress that, in 1979, it would take an estimated 575,000 overtime hours to keep the air traffic control system operating. Mr. Bond testified to Congress last spring that overtime has been reduced by all of 6 percent. That amount is still far too great. Standing alone, it is a sign of danger. When one realizes that the FAA figure is an average which conceals the fact that overtime is not distributed evenly at all facilities, the situation becomes alarming. In some of our major facilities, 6-day work weeks are a norm.

During fiscal year 1979, the Chicago Center, where controllers can count on working at least two 6-day weeks each month, used 26,604 hours of overtime. Cleveland Center and New York Center used more than 10,000 hours each. The New York "Common I" used 15,725 hours. The problem is not limited to the biggest facilities either. Binghamton, New York, accumulated 1,363 hours of overtime. Even assuming the unlikely situation that they were fully staffed to the authorized level of eighteen controllers, that still works out to 76-six hours per man, or virtually two extra weeks of work in a year.

Of more concern than excess overtime, is the fact that many facilities are operating far below even FAA's revised authorized staffing levels. A review of actual employment figures continuously turn up situations where facilities are operating with less than the number of authorized controllers.

To get a more accurate picture of the situation, we asked FAA to provide us with a definition of a "critically staffed" facility and to delineate any facilities that were in this category at any time during fiscal year 1979. FAA Headquarters replied that they do not maintain such data and suggested that we check with each of their eleven regions. Ten regions responded. They all reported that there were no published criteria for designating a facility critically staffed.

Only the Western Region would acknowledge that any facility was critically staffed in fiscal year 1979. They identified Los Angeles Center, Oakland Center and Burbank Tower as having been critically staffed at some point in fiscal year 1979.

The response from FAA's Southwest Region is particularly informative. They wrote us on March 7, 1980, as follows: "We do not maintain a criteria for declaring a facility critically staffed." They did not list any facilities as being critically staffed at that time. Yet, just 2 days earlier, the Region wrote a letter to the chief of the Plainview, Texas, Airport Traffic Control Tower, stating, in part: "We define critical staffing as continuing to provide all required services *using all operationally qualified personnel* including supervisors and staff with no reduction in services and no increase in the use of overtime." (Italic in original.)

Either we have a case of patent mismanagement in which the right hand does not know what the left is doing, or else the FAA has not dealt honestly in executing its obligations to the public under the Freedom of Information Act.

The most frightening aspect of understaffing is increased chance for errors in aircraft handling. Between 1974 and 1978, "system errors" (accidents that could have, but did not, happen) increased 68.5 percent. Another result of understaffing is a shortened work life for air traffic controllers. The cost of adequately staffing FAA facilities pales in comparison to the costs of training replacements for controllers that have their work life unnecessarily cut short. FAA must be made to acknowledge the personnel needs required to make our air traffic system function safely. Once the needs are acknowledged, the Agency must not shrink from seeking adequate funds from Congress to meet those needs and see to it that funded positions are actually filled.

While adequate staffing is an essential element of the human factors aspect of air safety, so is adequate equipment. It is axiomatic that a controller cannot perform with maximum safety and efficiency unless he has sufficient, reliable equipment to work with.

PATCO has testified a number of times in the past year before various House subcommittees regarding the alarming failure rates of FAA air traffic control computers. These complex machines form the backbone of enroute air traffic control and are located in each of the twenty domestic Air Route Traffic Control Centers.

The situation has not improved significantly, despite the publicly focused upon it. Controllers are frustrated by the system which mandates their accepting responsibility for air traffic separation, while being required to use equipment which is susceptible to failure in vital situations.

During the first 5 months of this year, there were 2,595 failures of those computers. Last year, there were over 6,000. The FAA would point out that of the outages so far this year, "only" three hundred exceeded 1 minute in duration. But, the length of time an outage lasts does not tell the whole story. The analogy has been made to a driver shutting his eyes while going around the Beltway at 55 miles per hour. That is a fairly dangerous condition, even if it lasts only a few seconds. The driver may emerge unscathed, but the odds certainly do not favor it.

The ultimate fear associated with an unplanned computer outage is that two airplanes in a controller's airspace will have a mid-air collision. It is a tribute to the air traffic controller's skill and dedication that an accident has never happened under these circumstances.

There have been, not surprisingly, a number of occasions on which there has been a loss of required separtion between aircraft during, or immediately following, a computer failure. Such situations are referred to, in the FAA's parlance, as system errors.

Within the past year, PATCO has received nearly a dozen such reports. In each, there had been a failure of the required separation between planes during a computer outage. Many involved passenger carrying jet aircraft. In each instance, the nonfunctioning computer was a direct, or contributing, cause.

FAA's Deputy Administrator Taylor, testifying before the Ways and Means Subcommittee last fall attempted to minimize the risks associated with computer outages, suggesting that there is "nothing unsafe" about the use of the backup, noncomputerized radar system. He claimed that this backup is a "fully adequate system for controlling air traffic".

The FAA's own internal analyses of system errors contradicts the accuracy of this last statement. In a March 29, 1979, error at the Denver Center, the FAA's review board found that the computer had failed at a "critical and inopportune moment".

In a November 27, 1979, Fort Worth incident, which involved two commercial aircraft, the FAA cited computer failure as a major cause of that error.

Taylor of the FAA has also asserted that there existed a comprehensive radar qualification training program. However, PATCO has been able to establish that there has been an appalling lack of controller training in the use of noncomputerized radar. Only now, nearly a year after PATCO first brought this problem to public light, has the Agency begun to institute a thorough refresher training course on the backup radar system.

The FAA must bear full responsibility for the lack of reliable computers and adequate backup systems, as well as the incredible foot dragging in the implementation of an adequate training program.

The FAA maintains that it is not planning to replace the current generation of air traffic control computers until 1990, and will not even solicit bids for the design of new equipment until 1985.

PATCO fervently believes that planning for a new generation of air traffic control computers should begin today. In furtherance of that goal, and on behalf of the millions of passengers using the system, we urge Congress to mandate immediate action. This subcommittee should hold FAA and Administrator Bond fully responsible should a midair collision occur as a result of a computer failure. The appalling status of the en route computers is only the most recent manifestation of the FAA's unwillingness, or inability, to engage in realistic long-range planning activities. Historically, the most significant improvements to the National Airspace system have come in the wake of, and not before, disastrous event.

The introduction of radar in air traffic control followed a 1956 midair collision over the Grand Canyon. Minimum safe altitude alert—MSAW— was introduced after a jet crashed into a mountain while approaching Dulles Airport in 1974. Intensive study of wind shear as a factor in aviation was stimulated by a crash at Kennedy International in 1975. While the FAA's response is best characterized as one of inaction, the Aviation Trust Fund continues to grow dramatically At the present time, it has assets in excess of $5 billion, the huge majority of which is uncommitted surplus. By contrast, the FAA generally spends less than one-third of a million dollars annually on facilities and equipment, claiming that is all it needs.

PATCO strongly urges this subcommittee to mandate FAA to use a vastly greater portion of the assets now available in the trust fund for the purpose for which the fund was created—namely, the purchase of modern, reliable equipment for the national airspace system. And, we believe that a top priority project should be immediate initiation of an accelerated program aimed at replacing the en route air traffic control computers well ahead of 1990.

Before closing, I would like to call this subcommittee's attention to one other area associated with the recognition of the human factor in air control. In 1972, Congress passed the Air Traffic Controller Second Career and Retirement Act. This law provides eligible controllers the opportunity for an earlier than normal retirement, and up to 2 years of federally supported academic, or on-the-job training at full salary.

However, in approving the fiscal year 1979 budget for FAA, Congress voted no line item funds for a continued second career program. With that, the FAA barred any new entrants and the program was effectively halted.

The Agency now states "we believe that providing second career training does not demonstrably contribute to maintaining a youthful work force, a key basis underlying the enactment of Public Law 92-297". But they offer no evidence in support of this.

In fact, however, the FAA reports contain data which refute this contention. The report to Congress indicated that after only 5 years of operation, there was a 7-percent increase in journeyman controllers below 30 years of age. A later study points out that during the last 3 months of 1978—after the discontinuation of funding for entrants into the second career program—the number of disqualifications had declined to a rate of 54 percent of the 1977 level, and 46 percent of the 1976 level. Based on these statistics, the FAA has concluded that there has been a 50-percent reduction in disqualification since the discontinuance of second career training.

FAA argues as if it were a negative attribute that the availability of second career training would have "induced" additional controllers to seek disqualification. Yet, this was the precise purpose of second career training. It was intended to discourage controllers from hiding their deficiencies. It was designed to give them assurances that they would have bonafide opportunities to obtain meaningful and rewarding alternative employment which would provide adequate income.

The data conclusively demonstrates that with loss of second career training, controllers are reluctant to step forward and this ultimately, and, perhaps, very quickly, will be detrimental to the safety of the air traffic system.

Nor should this result be very surprising to anyone. Former FAA Administrator John Shaffer, in testifying in support of this program, said "* * * I really am of the opinion that there won't be too many people who will opt for early retirement under this bill". He then went on to say, "They will produce far beyond the average if only we can train them to do some other kind of work—if only we can suck them out of control work into a career in which they may well make a greater contribution to the society and the economy than they can as controllers. At the same time, we can bring in fresh, young controllers, who are more adroit and facile at controller operations."

I submit that "suck them out" means the same as "induce", if somewhat stronger. Thus, what was once the merit of second career training as viewed by one FAA Administrator is now looked at as a deficiency by another.

In closing, Mr. Chairman, PATCO requests:

(1) That this subcommittee and the Congress mandate FAA to provide air traffic controller staffing commensurate with the increased amount of aircraft in the system and the unique needs of the controller to retain proficiency;

(2) That this subcommittee direct FAA to implement planning for a new generation of air traffic control computers at once, rather than waiting until 1985;

(3) That the Congress free the Aviation Trust Fund from the budgetary stranglehold now placed upon it, and that the moneys be used in projects for the enhancement of air safety; and

(4) That this Congress, in the interest of air safety, take action to restore funding for the second career program.

PATCO commends this subcommittee and you, Senator Cannon, for your sustained interest in the well-being of air traffic controllers and of the flying public. Again, we appreciate the opportunity you have afforded us to testify here today on these issues of vital importance to air safety.

The CHAIRMAN. Thank you very much, Mr. Poli. I want to say that we in the Congress specifically, as you know, a few years ago, increased the number of controllers.

Mr. POLI. Yes.

The CHAIRMAN. Because we were aware of a very serious problem. We have tried to impress on the administration and FAA the importance of computer and getting underway with a new computer program. You suggest Congress free the Aviation Trust Fund from the budgetary stranglehold.

I may say that is something that this committee has been trying to do for a long time.

Mr. POLI. I realize that, sir.

The **Chairman**. We have had not too great a success although we did have, just a few days ago, thanks to my two colleagues here, some success in getting some of our safety money back in. But we certainly agree with you.

I particularly agree with you that it doesn't make sense to have substantial surplus in the trust fund at the same time that we could use a substantial amount of these moneys for the purpose of increasing safety and making a better system of what I consider to be a very good system at the present time.

So I must say we are pretty much in agreement with you on a number of these issues.

Now, let me get back to some of the questions that have been raised here earlier.

I have been given a copy of PATCO's proposed strike plan for next March. What is the purpose of that strike plan?

Mr. **Poli**. First of all, Senator, I would like to bring to your attention that that is not a strike plan. It doesn't say strike plan on it. It was not distributed as such.

Our office, our national office, at PATCO, did distribute that document to our members. Our members are interested in any type of action that takes place in the union sector whether it be Federal or private.

In reviewing that particular document, I would like to bring to your attention, sir, that it states in there that striking against the Federal Government is illegal and punishable by imprisonment or fine. That is also listed in that particular document. That document is copied from documents that have been given to us by other unions who have strike plans, by other unions who have participated in some actions and are of interest to our membership.

As stated earlier, PATCO has in the past and will continue in the future to support the right of air traffic controllers to strike. We believe it is a right we deserve. We believe it is a right that we should have.

I also agree with the statement made by Administrator Bond that we do believe that the process that we deal in right now is collective begging. That statement was made by our organization and that is correct.

In no way is PATCO planning to go on strike in 1981 as put forward by the Administrator.

I would like to also answer questions relating to the other incidents that the Administrator stated are leading up to a strike in 1981. I will answer them at this time, Senator Cannon, or at any time you would like to address them individually, such as the New York situation, the controller in Miami or other circumstances that have been involved in the system in the last 2 months.

The **Chairman**. Let me ask you just a few questions.

From what you say, if I interpret your statement correctly, you are not preparing for a strike next March?

Mr. **Poli**. That's correct, sir.

The **Chairman**. If you are not preparing for a strike, why do you need such a plan as the so-called strike plan which you say is not a strike plan, and why has there been so much talk about a strike?

Mr. **Poli**. First of all, Senator, I can't control all 14,700 of my members. There is no question that Mr. Bond stated to you that there are publications out in the field where individuals have stated that they would like to see the organization go on strike. I am only telling you that as the president of PATCO, it is not my intention to strike in 1981. Those particular documents have not been circulated just recently. We have been circulating documents like that for years. We have put out documents concerning strikes, concerning court cases involving striking employees, concerning anything that has to do with strikes, whether it be in the Federal sector or private sector for a number of years. There is no intention on our part just to motivate the people at this particular time.

The CHAIRMAN. Have you engaged in any conversations about a possible strike this coming March?

Mr. POLI. I have had suggestions from people. I cannot say that has not happened suggesting that possibility. I have not engaged in any conversations other than that.

The CHAIRMAN. Do I understand your testimony correctly, that you have made it clear to your membership in this so-called plan that the union does not and will not sanction illegal job actions, is that correct?

Mr. POLI. That's correct, sir, and I testified to that on Thursday before Congressman Anderson's committee.

The CHAIRMAN. If you are not proposing or planning for any type of a strike such as has been under discussion, why has there been these separate questionnaires delivered to the membership, each containing questions related to a strike? I have seen some of those and they disturb me.

Mr. POLI. Yes, sir, that's correct. We have circulated, I believe we are in the fourth set now. First of all, we have answered all of those questions about those questionnaires to the Federal Labor Relations Authority that agrees that we have the right to do that. There are a number of people who constantly bring to the attention of any union, whether it be Federal or private sector, the intentions of the membership. The majority of the members feel this way. The majority of the members feel that way. I think that any union president is always put in that particular situation. It is our intent to find out exactly what our members feel, whether or not there are individuals out there who are telling us our members feel this way, whether it is true or whether it is not true.

However, I will reiterate again my previous statements. That in no way are those questionnaires being used to promote a strike by air traffic controllers.

The CHAIRMAN. Well, if there is no intention to engage in a strike early next year, why is the union collecting money for a strike fund?

Mr. POLI. Sir, I would like to bring to your attention that that has been done since 1977. We have a controllers subsistence fund. There are a number of ways in that particular fund that controllers can secure money. We are building up a subsistence fund, hoping that the day comes that we do have the right to strike. We have had that case adjudicated before the Federal Labor Relations Authority, the Department of Labor, as to the right of PATCO to have a subsistence fund. It was found that, by them, that we are allowed to have it. They did not rule in the FAA's favor, but in the favor of PATCO that we are allowed to have that fund.

The CHAIRMAN. Now, I would like to hear your explanation about the recent slowdown in Chicago. Why did it happen? Was it sanctioned by the union? What actions have you taken since that time to prevent your union members from engaging in that type of illegal activities?

Mr. POLI. First, in no way, shape or form did PATCO nationally sanction a job action or work stoppage in any way, shape or form in Chicago. Our organization is presently investigating that particular situation. We have informed the Congress last Thursday that if at any time this organization finds that there was an illegal action taking place in Chicago, any type of wild-cat action, we will move to, first of all, put that particular local in trusteeship and, secondly, to sanction the individual members responsible for any type of illegal action.

There is one thing that I would like to bring to your attention, though, with what has happened in Chicago so we have the whole picture of the entire Chicago story.

Number one, the individual facility rep at Chicago was charged with making a threat to the FAA by proposing a document that stated that they were requesting a bonus for being controllers in Chicago. That they would withdraw their enthusiasm if this was not received.

I would like to bring to your attention that our organization has demanded that that particular document be withdrawn from presentation to an FAA official. The national organization has taken that step. Because we feel that that document was misinterpreted by the FAA. But I would also like to bring to your attention, Senator, that that particular document was not thought up by a number of controllers in Chicago, but the money, as far as a bonus, to controllers in that area was suggested by a management study in the Chicago area in 1978.

The FAA's own managers suggested controllers in Chicago should receive a bonus to work there and to entice other controllers to work there in Chicago. That was an FAA suggestion that was followed through by the individual controller in O'Hare.

As far as O'Hare is concerned, I have heard allegations of illegal actions. I have heard allegations that there was a slowdown and I have informed you that we are presently investigating that situation. But I would like to bring to your attention that, No. 1, if we talk about staffing at O'Hare, the Administrator previously stated to this committee that we do have a problem with staffing in O'Hare, I want to explain to you what that problem is. No. 1, there are 87 authorized journeymen controllers at O'Hare. That is how many are authorized to be there. There presently is a letter from the chief of O'Hare stating that if it drops below 51, he is in a critical situation for staffing the facility.

At the present time, in Chicago O'Hare, there are 38 journeyman controllers working traffic in Chicago; 38. So I would think that before anybody accuses PATCO or any controllers of being involved in any criminal operation, that having half of the required journeyman controllers in a facility without doing anying about it might be discerned to be a criminal act by the Administrator of the FAA before he hides behind all the accusations of our organization.

As far as what happened last week, Administrator Bond had a press conference in Chicago and assured the press that there are minor staffing problems, but there is no big problem in Chicago O'Hare. But on Thursday of last week, they issued a Genot to all facilities that there is an emergency attempt to require controllers to go to O'Hare.

In fact, the FAA is making changes in the rules that they will hire military controllers with radar experience at the grade of GS-9 as opposed to GS-7 in an attempt to staff O'Hare. I assure you again, Senator, if there was a slowdown or any type of action at O'Hare, we will take action. However, I would like to address myself to the problems that exist there.

As far as O'Hare itself, there is runway construction taking place at O'Hare right now. O'Hare usually operates what, they attempt to operate what, triple runway operation?

With the construction and change of runways that happened that particular night, it limits their operation to two runways, at a time, that they can use. They can land on two runways. At O'Hare itself, they can land safely and within the rules on two runways, 66 airplanes an hour; 66 airplanes an hour.

Between the hours of 4 and 5 and 5 and 6, there are 87 airplanes scheduled for landing at O'Hare. These are facts. This can be documented.

There are times when they use two runways, and they put in excess of 66 airplanes on the ground at O'Hare. That leads someone to believe that the possibility exists that we are not using the required separation standards that are required by the FAA, but in some cases we bend those standards to insure that those airplanes get on the ground and exceed the work requirements of the FAA.

In fact, there is a document in the hands of the FAA which I can produce to this committee stating that unless controllers at Chicago O'Hare work at 150 percent on a continual basis during heavy traffic, that there will be delays at O'Hare. This is an FAA document that states that.

The CHAIRMAN. Would you furnish that to the committee, please?

Mr. POLI. Yes, sir, I will furnish that document to this committee.[1]

Mr. POLI. I make no excuses, Senator, for people involved in illegal actions and assure you our organization will take action against those individuals if that be the case.

However, I would like to bring that particular situation to your attention about Chicago O'Hare.

The CHAIRMAN. Did the controller conduct an illegal slowdown in 1978 over the jumpseat privileges?

Mr. POLI. Well, Senator, we were accused of being involved in an illegal slowdown, but I believe that in the settlement that took place, that we did not admit guilt as far as being involved in an illegal slowdown. We did pay a $100,000 settlement to the Air Transport Association for what they presented as evidence that there was an illegal slowdown that took place on 4 particular days in 1978.

The CHAIRMAN. Wasn't that actually a court finding?

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[1] The material referred to has been retained in the committee files.

Mr. POLI. Yes, it was, sir. It certainly was. It was an agreement that was reached, not necessarily a court finding.

The CHAIRMAN. Did PATCO take any punitive action against any of the members involved in that illegal slowdown?

Mr. POLI. As far as what happened in 1978, Senator; no we did not.

The CHAIRMAN. I must say, I have a copy of a letter from Mr. Schultz to Mr. Barlow dated July 30. That to me certainly, I don't know how it could be spelled out any clearer to make it appear that there is going to be a slowdown if certain demands are not met and those demands are not negotiable, so it says in the letter. There is no way Mr. Bond could acceed to those demands, because that is something Congress has to act on.

Mr. POLI. Senator, I agree with that. I would like to bring to your attention again, sir, that that was not generated by us. In fact, we took action to insure that that letter be withdrawn from the FAA.

Senator KASSEBAUM. Mr. Chairman, would you yield just a minute?

The CHAIRMAN. Yes.

Senator KASSEBAUM. I would like to ask, when will your investigation be completed on the question of a slowdown last Friday?

Mr. POLI. Senator Kassebaum, we are in the process right now of being just an individual party. In other words, the Justice Department is investigating our organization also. I have to submit to deposition tomorrow morning to the Justice Department. The situation in Chicago is in their hands right now as a result of the temporary restraining order.

I believe that within 2 weeks we should have our investigation completed.

Senator KASSEBAUM. You said that if you found that there had been illegal action taken at that time, that you would sanction them. What sort of sanctions do you contemplate.

Mr. POLI. First, I have the authority as president of the union to request that the executive board of the union put the particular local in trusteeship for violating the law. I also have the opportunity within the constitution of PATCO to discipline members who violate the law or produce actions detrimental to the organization or to the flying public.

Senator KASSEBAUM. Yet you said in 1978 you took no action?

Mr. POLI. In 1978 we did not; that is correct. I did not believe in 1978 that the action was precipitous by an individual local. I did not believe that that was the case in 1978.

Senator KASSEBAUM. Thank you, Mr. Chairman.

The CHAIRMAN. I personally believe that PATCO has a very valuable contribution to make in helping us improve air safety.

But many people in this industry have difficulty with the safety motives of an organization which defends controllers who vector airplanes into thunderstorms or toward thunderstorms, because they want free rides, and which accept the concept of leaving aircraft circling airports for hours as a way of handling labor grievances.

What does PATCO intend to do to correct what you strongly claim is the mistaken impression that the union will pursue its work-related grievances with illegal job action?

Mr. POLI. First, sir, I believe that any action that PATCO has been involved in in the past, if we were found guilty, that we have paid our dues in that particular area. I don't believe we admitted guilt in the case of New York. However, there were indications we were, and we reached a stipulated settlement.

I have a great deal of problems with people making accusations or allegations that any illegal act whatsoever was committed in Miami in the case with Mr. Ronald Palmer. We have had that case before an arbitrator and I believe a decision should be out approximately by the first of November.

In the Miami case, I would like to bring to your attention that we have proved conclusively that, No. 1, Mr. Palmer never knew there was any weather; No. 2, Mr. Palmer never vectored a plane into weather; No. 3, that the action taken by Mr. Palmer in the runway change insured that that particular airplane would be on the ground sooner than any other; that FAA under sworn testimony admitted Mr. Palmer was an outstanding controller never involved in any type of action of this sort, and the statement of the pilot himself in deposition that stated that he never entered any weather and suggested to Mr. Palmer, at the end of the statement, that he use that particular route for other pilots because he found it was safe.

I believe that particular case rests on the arbitrator's decision, but I also believe it was a trumped-up charge by the FAA against Mr. Palmer, who happens to be an officer of our union in Miami.

I will base my entire contention on the results of that particular arbitration case.

The CHAIRMAN. The one question that would arise in my mind, if you give—given all of those facts, let's say, is why the controller would ask if there was anybody in the jumpseat.

Mr. POLI. First of all, sir, I would like to bring to your attention that that particular portion of the tape where he asks about the jumpseat has been limited by the FAA. He asked two other Braniff pilots prior to that about the jumpseat. I do not defend his illegal transmission in asking about the jumpseat.

But in two previous cases with two identical airplanes, both Braniff, they said to the controller that he had given them outstanding service as far as vectoring them in.

It also came out in the case that there had been conversations about jumpseats not only by that individual in the past years, but other controllers and supervisory people of the FAA. I would like to bring to your attention that that tape is clipped to that one particular airplane. If there was an action being taken by that controller against Braniff, why did it not happen approximately 10 or 15 minutes earlier with the two Braniff airplanes that he worked in?

I do not believe in any way, shape, or form, that that individual controller was doing anything to intimidate the pilots except give them excellent service. He probably was wrong for bringing up the idea of the jumpseat on the frequency. But as far as doing anything wrong or endangering that airplane, the facts don't bear that out, Senator Kassebaum.

The CHAIRMAN. As a pilot, I must say I would be pretty shook up if I found out I was vectored right toward the heart of a thunderstorm, even though I didn't get that far. And that occurred shortly after the controller asked him if there was anybody in the jumpseat. I would find some relationship to that, in my own mind. I would certainly want to get out, I would want to get a vector out away from that thunderstorm as soon as I could.

Mr. POLI. First of all, being a pilot yourself, Senator, I think if somebody gave you a vector directly into a thunderstorm, that No. 1, you would respond to him by saying "170, this is a bad heading."

In that particular case, the pilot responds to him, "Oh, great, that is right in the stuff," which is not a normal transmission to start with.

But he said, understand, 170, he took the heading. I was a controller for 13 years and I never remember ever when I gave an individual pilot a vector and there was weather there, and he took it.

So I believe there was an explanation here in that there was a misinterpretation by the controller and the pilot as far as what he actually said to him.

The CHAIRMAN. Senator Exon?

Senator EXON. Mr. Poli, thank you very much. I have been very interested in your testimony.

A basic question. If the Congress would decide to grant strike privileges to the air controllers, would that not set a precedent for other Federal employees?

Suppose you were sitting on this side of the table, and I was out there. What is your answer to that question? Is it so necessary that your organization must have it? It's a very fundamental question.

Mr. POLI. It's a basic fundamental question, Senator, about the basic right of a labor union to have the right to strike as opposed to not having it. The question of being an essential employee, which we are classified, such as State, county, and municipal workers, some of them are classified, or city police or firemen.

However, I believe a prime example of controllers having the right to strike with the system still operating properly is in Canada. Air controllers in Canada do have the right to strike, and have been involved in strikes in the past. I don't see a deterioration of the system to where it has absolutely failed or the Canadian system is not functioning properly.

I believe automatically that the perception of a lot of people is that if air traffic controllers or any other Federal employee were given the right to strike, that there would be this mad dog attitude, that that would be the first thing that we would want to do, is to hold up the Congress or country itself for the wages that were cited by Administrator Bond, or by other people in the past.

That is not the case. I think that there are labor unions in this country that have the right to strike that are essential to the economics of this country. But it should be used frugally and properly.

I think we can exist in a society where people do have the right to strike, if there is an understanding by both sides, which I think other labor unions have demonstrated that that can exist.

Senator EXON. Then the basic thrust of my question was that you would agree that if you were in the Congress and you were going to vote for the right to strike by the air controllers, that you would therefore be agreeing to the right to strike by all unions?

Mr. POLI. Unless you made an exception for air traffic controllers and based it on the fact that Federal employees should have the right, yes, sir, that is correct.

Senator EXON. Therefore, you fundamentally believe a Federal employee should have the right to strike?

Mr. POLI. Yes, sir, I do.

Senator EXON. I was very interested in your citation of figures that there are only 38 journeymen controllers now assigned to O'Hare?

Mr. POLI. That's correct.

Senator EXON. I come at you not as pilot, I have never flown an airplane in my life but I have flown in airplanes, military and otherwise, all my life, so I am one of those Americans who rely on you professionals to do a job. I would like to say in this regard I frankly believe the 14,000 members of your professional organization do an exceptional job. I think they are under tremendous strain and pressure. It concerns me a great deal that you have only 38 journeymen controllers on duty in Chicago. And you said that the minimum necessary, in your opinion, for safety to do their job adequately would be what?

Mr. POLI. Well, 51 is a figure that has been used by the chief. Without that, they have to use massive amounts of overtime. I don't know what the exact figure is. But as of the first of this month they used in excess of 12,000 hours of overtime at O'Hare alone this year. When you have controllers who are under the constant pounding that controllers at O'Hare are being subjected to 6 hours—correction, 6-day weeks and 10 hours a day consistently and constantly, it gets to wear on you. They become very upset. I don't feel that they do their job as well as they could, if they were working a normal 40-hour week without the amounts of overtime that they have to work.

We are one of the—as the question was asked by Senator Cannon of Administrator Bond, we are one of the only countries in the world who still work 40 hours a week in air traffic control. A number of other countries who have nowhere near the amount of traffic that we do—an example of that is that in Chicago, which is the busiest airport in the world, they work more airplanes than London, Paris, and Frankfurt put together. And those are the three busiest airports in Europe. Chicago O'Hare works more airplanes than them. The vast majority of those controllers in Europe do not work 40 hours a week.

Senator EXON. I notice in your statement you read, "The subcommittee should hold FAA and Administrator Bond fully responsible, should a midair collision occur, as a result of computer failure." I suggest that is a rather strong statement, and I suggest that you would not have made that statement, unless you and your organization are critically concerned about the midair collision possibilities that I have had the feeling are having an increasingly likelihood of happening as each day goes by.

You must feel very strongly about that.

Mr. POLI. Senator, I feel very stongly about it to the point that in no way do I expect the Administrator of the FAA to wave some sort of magic wand and solve the problems that exist in the system right now. I know that he can't do that. I know the state of the art is such that if Adminstrator Bond sat before this committee and stated that PATCO is right, or the Congress is right, or I am right, making the decision himself, that these computers have to be replaced, that it can't be done immediately.

But I do think that he has the responsibility to correct some of these problems now as opposed to stating that we are going to put out bids in 1985 and have the new computer by 1990. The computer being used by the en route centers in this country is no longer available, not even to private industry, let alone to the FAA to buy. It's that outdated. There have been 2,000 failures of that computer since the first of the year, this year. The near misses that were asked questions by Senator Cannon and Senator Kassebaum, those near misses, as a result of the computer, there are 15 of them documented.

Now when I make a statement that Mr. Bond and the FAA is responsible in case a midair collision takes place, yes, I am very serious about it, because I think it is his responsibility today, to improve that particular system to get computers which we know the advanced state of the art are available, that can operate faster than the ones we have right now, to eliminate the breakdowns so that we know at least we are ahead of the curve in the future that the system will be safe.

Senator Exon. Trying to put yourself in the shoes of Mr. Bond, I have found in my life it's very easy for me to take a stand as a U.S. Senator or in any other position, in my private capacity, that represents my particular point of view. That is the easiest thing in the world to do. Why do you think Mr. Bond is holding back on obtaining of new computers? Does he think it's not necessary, or does he think it's too speculative? Do you care to speculate? Certainly, you are not accusing Mr. Bond of wanting a controller system that is not safe.

Mr. Poli. No, sir. I am not accusing Mr. Bond of that. I do not believe that Langhorne Bond legitimately sits at home and says, "What the hell. We will let the system alone." I don't believe that at all. But I believe Mr. Bond is getting information that is not correct, that has convinced him that the particular computer that we have right now is good enough to last until the timetable that he has set for getting a new one. I believe that he thinks that when there is a failure of a computer that as he stated earlier today, that you press a button and you get a new radar display really exists. I have a problem with that one, because I know he has been with air traffic controllers, and he says the difficulty that happens when a controller has to convert from the automated system to the old broad-band system, and bring the overhead down into a vertical position. He knows it is not merely pressing a button. He knows that thing has to come down, that you have to reidentify the targets, and this takes time.

I think the perception of a lot of people is that when they say a computer failure, it's similar to when they are standing at a counter at an airport and the person working for the airline says, "Gee, the computer just went down. Could you wait a second?" That is exactly what happens to an air traffic controller. When that image freezes or it stops, or they say the computer is inaccurate, it stops. Those airplanes are moving though. That controller might have to make that adjustment or wait for that computer to come back up, but he might be working 15 airplanes, who at the particular time are moving in some cases in excess of 500 miles an hour.

I don't think there is anybody who would go out on the beltway with a blindfold on and drive their automobile for 10 or 15 seconds at 15 miles an hour, let alone those airplanes moving at that speed without the computer working. Those are the kind of things happening. The problems brought about by it when they saw the computer was down for 4 or 5 days such as Chicago, Mr. Bond testified this morning, which is correct, that that computer was down for 10 days at Chicago O'Hare, that was correct.

I would like to bring to the Congress attention that during that period Mr. Bond gave those individuals a citation and awarded them with a cash bonus for the outstanding job they did.

But in the case of a center controller, when that thing freezes, those airplanes are still moving. It is not automatic to where he presses a button and the targets are placed exactly in the same place that they were. They are displaced when he converts to the other system.

Those are the problems that exist in the system that I think have to be addressed immediately.

Senator EXON. You said, Mr. Poli, that Mr. Bond was receiving information that you obviously think is not accurate, or at least reliable as it should be. From whom is he getting this information?

Mr. POLI. From his supervisors and people designated to respond to Mr. Bond as the Administrator on the different functions that take place within the FAA.

I certainly don't portray myself as an expert on the problems that exist with certification of airplanes, but I think I can speak very well as a person who was an air traffic controller to the problems that exist in that area, and to the problems that exist from the technician standpoint, what exists in the documents that are presented to the FAA on the outage of the computer, because there is no question in my mind that there are pressures brought on supervisors in the FAA by upper management to insure that those particular computers are up on a continual basis and don't have to be a maintenance mode.

I believe there are pressures brought on people to ensure that those computers are up all the time and maintenance records don't show that there is tremendous down times for those computers. I believe as a result of that, that the Administrator has been told that the system is not that bad, they can operate with this computer.

However, with the people who operate it on a daily basis and with the people who perform the maintenance on it on a daily basis, I have been informed differently, and that is why I feel that strongly about it.

Senator EXON. How long have you been president of the organization?

Mr. POLI. I have been president of the organization since the 1st of February of this year, and I was elected as president because that particular term of office was up this year. I was elected on April 24 of this year to assume office June 1.

Senator EXON. But you have been involved, how long have you been involved in the profession that you represent here today?

Mr. POLI. As far as the profession is concerned, Senator, I started as a controller in Pittsburgh in 1959, transferred to Cleveland in 1962, as a journeyman air traffic controller, and worked in the system until 1972, when I was elected to the vice-presidency of the national union.

Senator EXON. So you have been in this between 20 and 25 years. With that background, I guess what I am searching for is why is it that we have the strong difference of opinion today between strong experts? You are an expert in this area. I recognize you as such. Certainly the people Mr. Bond is getting his information from are experts. They have been in that business a long time.

I know experts disagree from time to time. It is very difficult for me as a layman to understand how experts can so widely and divergently disagree on something that to a layman sounds so fundamental.

Mr. POLI. I think that part of that goes back to the hearings held last week by Congressman Anderson from California on the question as to whether or not the separation of authority should exist between the FAA's promotion of aviation and the safety aspect of aviation. That it should be one or the other.

There were three bills introduced at that time. I believe that the Administrator of the FAA or some of the people who advise them think more strongly about other areas that should be pursued as opposed to the areas we feel as air traffic controllers are the most important to the people we feel are the most responsible for keeping their portion of the operation going.

I feel that legitimately he has been advised that there is no problem with these computers. I think some of those people really believe that. But they aren't the people who are constantly sitting in front of those computers on a daily basis. When you talk to the manufacturer of that computer as to the problems that are going to exist in the future, inasmuch as they signed a contract with the FAA that they will be able to provide parts for the computer as it fails in future years, they don't say how long it will take.

We are approaching the time when the stockpile of parts for that computer are going to be diminished and possibly that the manufacturer will have to hand tool that particular part for that computer in the future. That already happened in one situation.

I just believe that those people, I don't think, as much as I make my statements very strongly that something should be done and I stick by that, and I think that it should, I just think that they are ill-advised as to the real problems that exist in the system with that computer, and it should be upgraded immediately.

Senator EXON. How old is the computer system at O'Hare?

Mr. POLI. At O'Hare it's different. At O'Hare it's the ARTS IIIA system as opposed to the system used in the air control centers. The computers we are talking now about replacing are the ones in the centers. The computer at O'Hare is relatively new.

The problem that existed at O'Hare was with the recording of data that overloaded the computer and caused it to go down. In other words, they were recording all the data that existed in Chicago, but there was such a tremendous amount of traffic that it couldn't handle both functions.

I believe the FAA is working on that now and will possibly work that out. But at this time they are not recording the data in Chicago as they should. The ones I am talking about are the computers in the air traffic control centers that originally were purchased back in the 1960's, and implemented as far as the start of training, in 1972, but actually went on board in about 1974. But at the time they were on board, because they have to operate behind this curve from the time they purchased it until the time they get it on board, the computer at that time was approaching being obsolete.

Senator **Exon**. Mr. Poli, in finishing my questioning, I appreciate very much your coming here, because I think that the Congress is almost universally concerned about this matter. I would just say that one of your statements that you made in response to earlier questions regarding that you thought the controller in Miami, Mr. Palmer, I believe, was probably wrong in giving the information about the jump seat, is an attitude that concerns me very much, because I don't think he was probably wrong. He was very wrong.

And I guess that what I am trying to do is figure out the legitimate concern for air traffic safety, computers, that I have talked with the chairman about on numerous occasions. I don't want to get that tied up though, nor do I think it is proper for us to get that tied up on the activity for strike rights by your organization.

So that is a very fundamental concern of mine and I wanted to express it to you.

Mr. **Poli**. Senator Exon, I would like to amplify my statement on the situation in Miami. I am not here to defend that particular individual for discussing something that could have been an illegal transmission, which will be determined in the future whether or not. The only thing I want to emphasize to the flying public and to the Members of the Congress and this committee, that in absolutely no way was there an attempt of intimidation of that particular pilot as far as vectoring him into a thunderstorm. I assure you of that.

I know that individual. I have thoroughly been involved with that particular investigation in the defense of that individual, and I believe it is the responsibility of people in these particular positions that once that case is decided, that they take a look at the record on that particular case to decide based on all of the evidence produced as to whether or not that individual was guilty of the charge by the FAA.

Senator **Exon**. Thank you, Mr. Chairman.

The **Chairman**. Senator Kassebaum.

Senator **Kassebaum**. Mr. Poli, there is a transcript, and whether Mr. Palmer had intended to relate the two incidents, I think it is disturbing that he made the comment. The pilot having said, "Oh, great, that is right in the stuff," Mr. Palmer said, "I want to make sure you get this information back to your vice president. You know what I mean." And the pilot said, "No, I sure don't." I am not in a position at this point to get into the placing of blame, but it certainly is disturbing to us, as I am sure it is to you, to have this type of situation develop.

Mr. Poli. I think that as far as the confidence of the flying public, that certainly that particular situation at face value without more investigation appears that way. But if you go back further in the tape, as I said earlier, with the conversations with the previous Braniff pilots, all of them said that they were getting exceptional service that particular day. And there was a comment on the tape where he stated, how are we doing today? And he said great. You know, I mean the system is operating very well. That particular controller is noted for his going out and trying to do more than he is required to do to help pilots. It was just a straight-up case of misinterpretation on his part as to what the pilot said, because we proved conclusively in a hearing why he gave him that particular heading. But I think that will come out in the hearing and I hope the confidence in the system and the amplification of it by certain individuals within the FAA doesn't happen again prior to an investigation taking place.

Senator Kassebaum. Well, for all of our great technology in computers and simulators and so forth, it really does boil back down to the purpose of this hearing. That is human error, and its relationship to pilots and controllers. I certainly would want to join both Senator Cannon and Senator Exon in my support for the fine work the controllers do. It really is, for someone like myself who knows very little about the industry, a marvel that it functions so well.

As technology improves, and traffic increases, it's going to be increasingly important for there to be a good personal communication between the pilots and controllers, because obviously, that is an important relationship. I wonder if PATCO has taken any initiatives to enhance communication between the pilots and controllers?

Mr. Poli. Yes, we do. We as an organization have sponsored a lot of pilot/controller forums. We are constantly asking the airlines to be involved in more visits to our air traffic control centers and towers similar to the program we have as far as involving ourself in the training program sitting in the jumpseat of airplanes. We have done everything we can to enhance the relationship between pilot and controllers. I do not believe at this particular time there have been rumors to that in the past, and relationships in the past maybe haven't been as good as they should have been, but I don't think there has ever been a time when there is a more cohesive understanding or an agreement between pilots and controllers as to getting to know each other and to making the system work as safely as possible.

Senator Kassebaum. I had asked Mr. Bond about the timely communication of weather information. Do you have any recommendations with respect to weather update problems. Can controllers play a more important role in this area?

Mr. Poli. I believe that they can. I would rather not address myself to the situation with the commuter airline that you brought up earlier because that presently is under investigation by the NTSB and we have an agreement as a participant that we won't discuss it. However, I believe in the centers where they have these meteorologists, that the Administrator and Mr. Van Vuren talked about earlier, that there should be better use made of them.

I have investigated how they are being used. And in some cases they are being used to brief the supervisors but not necessarily the controllers. And the controllers themselves aren't getting the type of weather briefings that they should get. I feel an effort should be made to use those people to better advantage to insure that when a controller comes on duty, that if there is weather in the area that they know about or are expecting, that they are given a complete briefing in that area. I don't think that is being done.

I think the effort was made, just so I can clarify the record, that I am not taking another shot at the Administrator, I have a little something good to say, I don't think that it's their fault in that they have tried by putting these people in there. But I do believe that additional effort should be made to insure that those people talk to the controllers as opposed to just talking to the supervisors.

Senator **Kassebaum**. As a former air controller, do you feel a controller could be of greater help to a pilot in assisting him in making proper decisions with regard to the weather?

Mr. **Poli**. I certainly do. We do that all of the time. We attempt to vector airplanes around weather. We constantly are advising pilots of the weather. Pilots have weather radar on the airplanes but problems exist with it. They might obtain things we do not obtain on our radar; however, we get a better picture than they do. Their radar cannot see around a corner, just what is in front of them. That came out specifically with respect to the situation in Miami as to the weather. We attempt to vector the airplanes around the weather. That probably in the life of a center controller is the most difficult situation you might get involved in, in that the captain of the airplane is responsible for the safety. Just because the prescribed route of flight is over a certain area, if there is weather in that area, he will depart that airway to insure the safety of the passengers in his airplane. And the controllers must follow that airplane to insure it is separated from the other airplanes and get them down properly. But we do, any information we get in that particular area to help us advise the pilot certainly helps the system a lot.

Senator **Kassebaum**. Thank you, Mr. Chairman. I have a couple of questions that would really apply to both Mr. Poli and Mr. Bond.

The **Chairman**. Mr. Bond, will you come up to the table, please.

Mr. **Poli**. Do you want me to stay here, Senator?

The **Chairman**. Yes, I think Senator Kassebaum has some questions for both you and Mr. Bond.

Senator **Kassebaum**. Some of these have been somewhat covered before. But I thought it would be helpful, since they really are ones that affect you both, to have you respond together.

Mr. **Bond**. I would be pleased to do that. May I make an observation?

I could not help but sit in the back of the room here and be impressed with the reasonable and glossy presentation Mr. Poli has made.

Mr. **Poli**. Thank you.

Mr. **Bond**. That is a compliment to performance but not reality. So let me give you some reality.

The reality, for example, in 1978, there was a nationwide illegal strike, a slowdown in the air traffic control system. It is true that the court did not formally find guilt. But that might have been helped by the fact that the president of PATCO took the fifth amendment more than 35 times when asked about his own role in that nationwide slowdown. There was, therefore, some lack of evidence in the matter.

I cannot believe that reasonableness and sweetness and light characterizes this national organization's posture. The opposite is true. There is a constant stream of materials, statements, encouragement, written documents, buttons that have strike mottos on it flowing out of national headquarters to the field.

We have had controllers urged by their organization, walk away from our local safety committees, called the "FATAC" committee, which is the coordination committee in local systems.

What these folks are doing, no matter what they say publicly, is devisive, hostile, and in fact destroys the kind of cooperation that is so essential to the human/machine interface of our system.

The reality of this absolutely does not comport with the statements that have been made to this committee about not leading up to a strike in 1981. The opposite is true. If it walks like a duck and quacks like a duck, Senator, then it most certainly is a duck.

Senator **Kassebaum**. My first question is regarding the situation at O'Hare, and the charge by PATCO that there are insufficient personnel to operate O'Hare as well as other control towers.

Mr. **Bond**. Part of the problem is our own in the way we define controllers and define staffing standards.

First of all, it's very hard for anybody to sort their way through the Federal bureaucratic language. There is a difference between an authorized standard and in fact a standard. And there is a difference between a FPL level and a usable controller level. Let me give you the facts here.

It is true, for example, that in the tracon, the radar room at O'Hare, there are 87 authorized positions. But our staffing standard in fact calls for only 71 positions in the facility.

The staffing standard in many of our facilities has been revised and modernized and calls for less than the authorized levels. In fact, all over the FAA are authorized levels which have their roots in historical circumstances which are, and the actual employment is way below that level.

Our old staffing standards and old authorization levels were wrong. The experience has clearly indicated that. The actual level that is supposed to be the staffing standard in the case is not 87 for the O'Hare radar room, but is instead 71. We are not at that level. We have 40 full performance level controllers and 10 trainees that are fully usable on positions. So the staffing in the O'Hare radar room is 50. It ought to be as high as 71.

So it is correct we are below what we ought to be at, and we have to do more overtime. Let me just go on, ma'am, and tell you about the tower, because our facility is the tower facility in the radar room. We have 31 full performance controllers and 8 trainees fully usable on the boards, legally making a total of 39 folks in the tower cab and the staffing standard there calls for only 31, so we are 8 over in the tower.

Senator KASSEBAUM. Mr. Bond, you say, though, that because staffing standards are low, overtime is required.

Mr. BOND. That's correct; yes, ma'am.

Senator KASSEBAUM. So you are doing all you can to upgrade.

Mr. BOND. That's right. Let me be specific about the amount of staffing required at the O'Hare facility.

In 1979, calendar year 1979, there was an average of 16 days per employee or 1 day every 3 weeks or 1½, 1⅓ days per month of overtime required. That is more than we would like to see, but I don't believe it is excessive.

I think it is especially important to realize that much of that overtime is requested by our employees. Many of our people would like to work overtime, night or offpeak period.

Senator KASSEBAUM. That is all voluntary?

Mr. BOND. They volunteer. They get paid time and a half, premium rates; they are putting their children through school, so they volunteer. So that has to be discounted by the fact that many of our people actively seek it.

After the people who seek it are taken care of, then we assign it on a mandatory basis. I don't think it's a critical situation.

The CHAIRMAN. Would the Senator yield?

I have spoken to many controllers who have raised the question and said don't take our overtime away. Let us have the chance to get some overtime. I must admit that there are levels that are perhaps too high or if they are called on to work when they are not assigned to work, might not want to do it for their own reason. But many have assured me they do want overtime. They don't want to see the staffing level at such a level they could not get overtime.

I thank you for yielding.

Mr. POLI. Can I respond, Senator?

First of all, I don't believe that situation normally exists at O'Hare and I disagree with Mr. Bond's calculations. I believe the projections in the future of what they have at O'Hare that a controller will have to work 3 out of 4 weeks in the future on the basis of the scheduling which is taking place out there right now.

PATCO is constantly accused of getting involved in situations by withdrawing services to FATTAC committees. I would like to explain to the Congress what that is, because it looks like we are dodging the draft or not registering or burning the American flag in front of the White House or something like that.

That is a committee the FAA asks controllers to be involved in as far as procedures are concerned. In other words, you make your recommendations as to how the procedures at this particular airport or center should operate. We encourage our people to get involved in this.

However, there comes a time when our recommendations fall on deaf ears and someone in FAA management feels they can operate the system better with their recommendations than air traffic controllers can.

As an example, the situation in Los Angeles where the air traffic controllers withdrew from the committee because they made recommendations as to how the airport should operate. The management at the airport said that the controllers were wrong and that they were right, and initiated a new policy which the controllers couldn't go with, so they withdrew from the committee.

They were running 45-minute delays at Los Angeles. Initially, I was called as president of the union as to, well, what happened out here? Are you running a slowdown? This one didn't reach the newspapers in any proportions. I said, "No, we are not running a slowdown." The truth of the matter is that you are running a bad system initiated with your manager with gate hold procedures at Los Angeles.

Management asked me, if you are telling me if we change the system the delays will stop? I said, "yes." They stopped in 8 hours. That is why we do not participate—they don't listen to us—not as an action against the Government.

Senator KASSEBAUM. If O'Hare seems to be such an enormously difficult staffing problem, and evidently it is the worst in the country, has there been any effort made to upgrade the status for the controllers at O'Hare above other airports?

Mr. BOND. We have been dealing with the question of staffing at the O'Hare tower for 10 or more years. The dilemma is not only that we have a hard time getting folks to come into it, but that we have a hard time getting people to stay.

Everybody knows the controllers at O'Hare are exceptional controllers. They would have to be. It is the toughest in the country. So they are naturally targets for promotion.

A lot of people out of O'Hare are now supervisors, have moved up into management. So a constant flow of folks go out of O'Hare into superior positions, which is to their credit.

We also have a program underway which is a guaranteed out. We try to attract people into O'Hare with the promise that they will be able to leave it after some years of service. So they figure, "Well, I can't stay there forever."

That program is one per quarter, one controller every 3 months guaranteed to go to another facility, almost always where the weather is good, in the Sun Belt, as an incentive.

So that is an outward drain as well. We have been considering other promises. The bottom line is that the average stay of the full performance controller at O'Hare is less than 4 years. In many of our facilities, particularly those in the South, they are forever there. They like it and stay. They don't regard it as a way station.

So we have a problem with motivation. The folks don't want to stay in Chicago very long.

Senator KASSEBAUM. Do air traffic controllers at National have a higher grade than those at O'Hare?

Mr. BOND. No, they are 14's. The pay is excellent. The average at O'Hare is $43,000 and the best paid is $56,000. Compared to almost anything else in the city of Chicago or anywhere else, that is darn good.

Senator KASSEBAUM. I would like to go back just briefly to the earlier question regarding what type of legal action, if necessary, should be taken.

Frankly, I did not know or realize there were no criminal statutes that dealt with any action that would be a deliberate vectoring of an aircraft into a life-threatening situation. I am sure you would agree, Mr. Poli, that this is a problem we should address, and I would guess that PATCO would support.

Mr. **Poli**. There is no question in my mind that in the case of a deliberate act by anyone, air traffic controller or anyone, to endanger that airplane, that he should be subject to criminal statute.

If, as I said earlier, the penalty is justified as opposed to making the blatant statements about what happened similar to the situation in Miami without knowing the facts, if it bears out that that particular individual was guilty of endangering life intentionally, then I think that the person should be punished. I don't think that there is anybody who would disagree with that.

But I have a big problem with the FAA attempting to defame or discredit a union officer by making statements about his guilt prior to the individual even having the opportunity to defend himself.

Mr. **Bond**. Senator, on the question of penalties, there are penalties that apply, though they are not specifically addressed to the situation. For example, attempted murder is a State statute. That is one that could apply.

Interference with the performance of an air traffic control facility is a much broader one, drafted when the thought was somebody might blow up a critical military facility. That might apply as well. But it doesn't apply very well. That is the problem. We are thinking of a more specific one.

Senator **Kassebaum**. That was the reason that there was no prosecution, then, in the New York case? Was there found to be no criminal activity involved?

Mr. **Bond**. We urged the prosecutor to go forward. The fact that the likelihood that the machine did it was more than a billion to one, according to risk analysis, was enough evidence for us that reasonable cause might exist.

But I don't know why the prosecutor didn't go forward with it. I can't give you the answer to that.

Senator **Kassebaum**. It would have been helpful, it seems to me, to have cleared the situation for both sides.

Mr. **Poli**. As far as that particular case, Senator, I believe that there are some attitudes that it was just a cursory investigation.

I would like to bring to the attention of this committee that the FBI was in that facility. They completely investigated it. That a number of controllers appeared before a grand jury in New York. And that the Government decided that—they made a statement last week that they didn't have enough evidence to prosecute the case.

Mr. **Bond**. I would like to ask our attorney, Clark Onstad, who has been in on this, to address this more fully, Senator.

Mr. **Onstad**. In fact, Senator, the FBI, in my presence, with the U.S. Attorney in Brooklyn, represented criminal prosecution. It was based upon the situation of A, not having a specific statute in question, and B, a problem with a particular witness who has failed to come back to work since the incident, that he did not go forward with criminal prosecution.

This gentleman is an air traffic controller who has been subjected to incredible pressure since the incident, peer pressure and other pressure, and he simply was deemed not to be a fit witness to undertake prosecution.

Mr. BOND. Senator, I want to expound on that, because I continue to be concerned by the attitude of reasonableness given here before the television cameras and the Congress, which is absolutely at variance with what goes on out at the air traffic control facilities.

The peer pressure, isolation in cases where people do not talk to other controllers, where mental pressures are brought to bear on people who do not go along with radical activities is very strong.

It's been clearly documented in the case of a St. Louis tower, for example, where folks were strong-armed, threats to their lives were made, people wouldn't talk to them, people would not hand aircraft off into their sectors, threats done in the air traffic control process itself all clearly documented as a result of PATCO's pressure on others.

It may be in New York that they just browbeat and terrified another controller into weakening his testimony. But whatever it is, the peer pressure, notices on the bulletin board, thousands of papers that flow around through this system are hostile, aggressive, and lead to illegal action.

Mr. POLI. Senator, I would like to respond to that, please. I believe that all the controllers involved in the New York situation are back to work, all right. I also believe the situation Mr. Bond states where a controller was threatened, where there is a lawsuit against our organization, that I would like to remind him that none of those controllers were disciplined by the FAA. If there was any discipline to be taken in that particular case, if they thought that something of the magnitude which he displayed before this committee was going on in the facility, if he is the Administrator of the FAA, I certainly think it's his responsibility to take some disciplinary action. There wasn't any suggested in that particular case. All right.

Senator KASSEBAUM. In the case of St. Louis?

Mr. POLI. In the case of St. Louis, there was not.

Mr. BOND. I would concur in part of that statement. The FAA in the past has not been firm enough in upholding the law. It is one of the things that has grown more apparent to me as I stay as Administrator. There is no question that lack of action on the part of the Government encourages additional illegal activity. And we will not be stopped by threats. We will instead take every step that we can on the part of the Government to curb illegal activity.

Now in the case of the New York controller, the decision apparently having been made not to prosecute, we are then moving toward administrative activity and we will do all that we can support with the evidence in this case.

Senator KASSEBAUM. Thank you, Mr. Chairman. That is all I have.

The CHAIRMAN. Counsel has a question.

Mr. BARCLAY. Mr. Poli, to review quickly, PATCO has a plan which looks like what other unions call a strike plan, questionnaires on striking to your members, you have even given seminars to controllers' wives on how to handle periods when their husband might be on strike. How can the committee look at those facts and then take as accurate your statement that PATCO is not encouraging and would not condone an illegal strike?

Mr. Poli. I think it has to be based on the statements that we made advising our people that it is illegal and that we are not participating in a strike. We get involvement by wives of our organization, spouses, I would say, of our organization members in that they do come to seminars and they do ask an awful lot of questions. They are involved in the political action portion of our organization. However, the questions that they ask about illegal strikes have to be responded to by our organization.

When I am at one of those meetings and questions are asked of me as to what is involved in a strike, what will happen if we do get the right to strike, I answer those questions on a continual basis when they are asked of me and I am out in the field. I have never ever encouraged anybody to strike.

The Chairman. Thank you very much, gentlemen. That concludes the hearings this morning. We will recess until 9:30 tomorrow morning.

[Whereupon, at 12:57 p.m., the hearing was adjourned, to reconvene at 9:30 a.m., Tuesday, August 26, 1980.]

AVIATION SAFETY

TUESDAY, AUGUST 26, 1980

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, at 9:35 a.m., in room 235, Russell Senate Office Building, Hon. Howard W. Cannon (chairman of the committee) presiding.

The **CHAIRMAN**. The hearing will come to order. Today we will resume our hearings on safety oversight. The first witnesses today will be: Jack Howell, John LeRoy, John O'Brien of the Air Line Pilots Association, and Mr. Edmunds.

STATEMENT OF JACK HOWELL, EXECUTIVE CENTRAL AIR SAFETY CHAIRMAN, AIRLINE PILOTS ASSOCIATION; ACCOMPANIED BY JOHN LeROY, CHAIRMAN, ALPA AND INTERNATIONAL FEDERATION OF AIR LINE PILOTS ASSOCIATIONS WORKING GROUPS ON CREW COMPLEMENT; JOHN O'BRIEN, MANAGER, ENGINEERING AND OPERATIONS; AND WILLIAM EDMUNDS

Mr. **HOWELL**. Good morning. I am Jack Howell, executive central air safety chairman for the Air Line Pilots Association. With me today are John LeRoy, who is chairman of both the U.S. ALPA and the IFALPA, the International Federation of Airline Pilots Associations working groups; and also John O'Brien, manager of engineering operations in our engineering and air safety department; and Bill Edmunds, our human performance specialist, also in our engineering and air safety department.

On behalf of the 33,000 members of ALPA who fly 31 airlines, we are grateful for this opportunity to present our views on what can be done to improve airline safety. We are also pleased that the subcommittee has taken the initiative in these hearings by placing special emphasis on the role of human factors in airline accidents. We believe the issue of human factors in airline aviation has not received the attention it should from various Federal agencies, and we hope these hearings will lead to more research on human factors.

We in ALPA believe such research has been sorely needed for a long time. Human factors are involved in the majority of aviation accidents—anywhere from 60 to 90 percent of all accidents, according to various studies. Thus, it is clear that human factors in general are one of the biggest issues in aviation safety today.

Therefore, we are puzzled—and have been for many years—that human factors have not received more in-depth attention from accident investigators and others involved with aviation safety. Too often, the cause of an airline accident has been attributed merely to pilot error with little effort made to determine why the pilot made the error.

Was it due to inadequate training, fatigue, preoccupation with other matters, or poor coordination among the crewmembers? Or did other factors, such as cockpit instruments and design, misunderstood instructions from an air traffic controller or visual illusions, contribute to causing the accident?

In most accidents, it is not just one human factor, but a combination of elements that contributed to pilot error. That, of course, makes it more difficult for accident investigators to pin down all the underlying causes that contributed to pilot error. Nevertheless, we believe much more effort needs to be made to determine why human errors are made in airline accidents.

Intense efforts are commonly made to determine in minute detail the causes of mechanical failures. For example, an engine that failed will be completely disassembled and every part inspected in detail in an intense effort to determine why the failure occurred.

We can only conjecture why much more emphasis is placed on determining the causes of mechanical failure rather than human error. It may be that accident investigators, with their technical backgrounds, are more comfortable dealing with the tangibles of mechanical failure rather than probing factors that may have led to degradation of pilot performance.

Another element that tends to work against further exploration of human factors in airline accidents is the tendency to devise equipment that will help prevent human errors without making any real effort to understand what factors are causing the human errors. That is treating the symptoms but not the causes and is similar to taking an aspirin. Your headache will go away, but there will be no effect on the brain tumor that is causing the headache.

Let me provide an example. In the late 1960's and early 1970's, a major safety problem in airline aviation was controlled flight into terrain—CFIT. The aircraft, strictly through pilot error and without mechanical problems, flew into the ground and crashed. After repeated recommendations from the National Transportation Safety Board and a 1974 crash west of Dulles International Airport, the Federal Aviation Administration required all airline aircraft to have a ground proximity warning system, GPWS, installed.

The GPWS provides warnings to the cockpit flightcrew if the aircraft is descending too quickly, is too close to the ground, is in the wrong configuration, et cetera. The GPWS has been quite successful in reducing the number of CFIT accidents, but it has done nothing to address the underlying problem: Why do such deviations from the normal flight profiles occur?

To answer that question, we need more research on approach procedures, crew coordination and workload management, and pilot decisionmaking at low altitude in poor visibility. That research, and other work in human factors, would be a major contribution toward preventing accidents such as the one 2 years ago where a crewmember responded to the GPWS warning by turning off the system shortly before the aircraft landed short of the runway.

That accident and other recent ones clearly demonstrate that we need more emphasis on human factors in accident investigations. This added emphasis is needed not only to uncover information that will enable us to prevent similar accidents from occurring in the future. Such emphasis is also needed to determine basic truths involving human factors that will be applicable not just to specific types of accidents, but to many other facets of airline aviation as well.

While we clearly see a need for more human factors work in accident investigations, we also point out that accident investigations are not the best source of information on human factors problems in airline aviation. Reports of these investigations show only what has happened and usually do not indicate the current level of safety conditions in the airline industry or what problems might arise in the future.

A far better source of information is reports of near accidents and incidents. These can detect potential trouble spots and show trends in airline safety as they develop. One reason that these reports are more valuable than those on accidents is that the former are much more numerous. Another is that those making the reports are available to provide additional information.

ALPA believes that we and everyone else in American aviation are very fortunate to have the aviation safety reporting system, which is run by the National Aeronautics and Space Administration. We strongly believe that a strong ASRS is essential in providing what we in aviation need to improve our safety record.

ASRS has already proven to be very useful in providing information on a major problem area in human factors: management and decisionmaking in the cockpit.

A basic problem in cockpit management is communications—both among the members of the crew and between the crew and the air traffic controllers. ASRS reports indicate that communications errors lead to near accidents every day. Two brief examples will indicate the nature and scope of the problem.

In one instance, neither the captain nor the first officer checked or asked the other if the aircraft had been refueled. It had not, and they took off with insufficient fuel to reach their destination. In another incident, the cockpit crew thought the controller told them to fly a course of 180°—which was close to the course they were expecting—rather than the course of 80° he did give them.

The problems in cockpit management were well covered in the resource management workshop that NASA sponsored in the summer of 1979. Some airlines are already beginning to implement their own programs of cockpit management in order to make the best use of all the resources available. However, ALPA believes more emphasis and research are needed to develop the best methods of cockpit management in current and future airliners.

We also see the need for more human factors research on decisionmaking by pilots. Decisionmaking often becomes critical during approach and landing when the pilot may have only a second or two to observe several complex decisions that will determine if he continues the approach and lands or if he will execute a missed approach and go around.

If the pilot makes a wrong decision in this very restricted and stressful time period, he runs the risk of crashing. If that happens, the NTSB will spend months analyzing what happened in those few seconds.

Research in decisionmaking involves such items as visual cues in rain or fog at night and the information to be presented and symbology used in a headup display. More research on pilot decisionmaking is particularly needed in view of the current trend to lower landing minima, which give the pilot very little time to decide whether to land or go around.

Another major problem area in human factors that is long overdue for additional research is crew workload. Our view is that surprisingly little work has been done at the FAA in this area, which is an obvious and essential element in human factors.

As you, Mr. Chairman, and the subcommittee are aware, a very controversial issue in the airline industry and with ALPA is crew complement, or whether two or three crewmembers are needed in the cockpit to assure the highest level of safety. Clearly, workload is one of the key elements needed to make a rational determination on crew complement.

We are dismayed both at the FAA's conclusion over 2 years ago in its crew workload study that few advances had been made in studying flightcrew workload and at the agency's failure to undertake further research. At a scientific symposium sponsored by ALPA in July 1978, many recent advances in workload study were demonstrated. We believe the FAA should have applied this knowledge in its aircraft certification process to make a complete and realistic assessment of cockpit workload.

Considering the importance of the crew complement issue, one would think much more research would have been done on the question. Unfortunately, that is not the case. There has never been an independent and comprehensive evaluation of the crew complement question, including all aspects of flightcrew workload.

We urge the subcommittee to consider authorizing such an independent study to settle the issue of crew complement. There is a wealth of expertise at NASA and in the military services that could be applied to such a study. We also believe it is especially important that such a study of workload and crew complement be carried out under conditions that accurately reflect the day-to-day airline flying. There is a vast difference in pilot condition and workload between making the 1st landing of the day in clear weather and making the 10th landing of the day in darkness and bad weather.

Another area that involves many aspects of human factors research is the growing use of simulators in flightcrew training and checking.

We also support the concept of total simulation as described in the FAA's three-phase program that was implemented last July. However, there is no phase III simulator in existence today, and we should not close our minds to possible future changes in technology that could make the phase III simulator even better. It is definitely within the realm of technical possibility to do much of the training required for various airman certificates in the simulator.

I would summarize our discussion of human factors by saying they are the key element in airline safety today. More extensive and intensive research in almost all aspects of human factors will be needed if we are to improve our generally enviable record of airline safety in the years ahead as our skies grow more crowded and complex to fly through.

That completes our statement, Mr. Chairman. We thank you for this opportunity to testify, and we are ready to answer your questions.

The **Chairman**. You left out your three final comments that are on my sheet here. Was that by inadvertence or design, Mr. Howell?

Mr. **Howell**. By design, in the interest of brevity.

The **Chairman**. I think those are obvious points that certainly should be considered from the standpoint of safety. Some method of improving the information available with respect to windshield problems and also better weather information for the pilots, and, of course, the runway grooving—maybe I should ask you: How is the runway grooving program coming along now with respect to air carrier airports throughout the country?

Mr. **Howell**. In our opinion, much too slowly.

The **Chairman**. Is substantial progress being made on it at the present time? I am sure it is too slowly if it isn't all done at once.

Mr. **Howell**. John, do you have some specific numbers with respect to runways?

Mr. **O'Brien**. Runway grooving is proceeding. More were grooved this year than last year, and we are encouraged over this prospect. The primary holdup in getting more grooved runways, at least in our opinion, is the lack of funds. And as we testified before this subcommittee a few months ago, we are concerned over how the funds for grooving are going to be allocated in the upcoming ADAP program. Large airports today need funding for runway grooving. So, depending on how this potential splitup of airports and their participation in ADAP funds evolves, I think that will have a determination on how fast you see runways grooved.

The **Chairman**. Is there still any substantial controversy on the runway grooving issue or is that pretty will simmered down?

Mr. **O'Brien**. There are some that still hold the opinion that runway grooving may not be the best way to improve friction on the runway surface. There are other methods. There are porous friction surfaces, and keeping deposits off the runway would improve the coefficient of friction.

In our opinion, runway grooving is the best method, and we have documentation to prove this point.

The **Chairman**. I am sure that you gentlemen heard the Administrator's announcement that FAA will propose a rule to begin checking crew performance and workload by reviewing voice recorders and flight data recorders. What is ALPA's view of that?

Mr. **Howell**. We are less than enthusiastic about that concept, for at least three reasons:

First of all, we have serious mistrust of the FAA's use of the cockpit voice recorder, in particular, arising primarily from past abuses of the CVR as an accident investigation tool.

Second, we see the combined use of CVR and the FDR, flight data recorder, as perhaps giving the FAA license for an overall witch hunt for violations.

And third, we see the CVR and FDR as really providing a rather incomplete data base about what is going on in the cockpit. The FDR traces show the performance of the aircraft, in many cases only six parameters. The CVR reflects only noises. That is a very limited view of what the processes are in the cockpit.

The CHAIRMAN. Mr. Bond testified yesterday that they were not intending to use it, and would not use it, as an enforcement tool. So it seems to me that that kind of assurance ought to alleviate some of your concerns, and in the past few years we have developed a "sunshine" atmosphere around here in the Congress and many other areas in the country. It seems to me that pilots should probably not object to working in the "sunshine," when they are called upon to perform in a professional manner.

I would see the use of these types of things as—just as an aid in determining how you could better improve performance in the cockpit, rather than a baseline issue that would be the sole determinant. I hope that you won't lock yourselves into that kind of a position too soon in this process.

It seems to me that the CVR and the flight data recorder could provide valuable information for proficiency training of individuals who might show that they need extra help in certain areas. This would seem to be a way, a possible way, of avoiding accidents in the future. Do you dispute that?

Mr. HOWELL. I harken back to my opening statement where I said we were less than enthusiastic about embracing this overall concept. I would submit that we probably are not locked into opposition to this. There are some road signs along the way we would have to follow to insure that the FAA did stick with the promises that they have made this time, because we have also heard similar ones in the past. There may be other ways to get the information that we seek. One of them, of course, would be the ASRS which we have already discussed in the opening statement. The ASRS report allows the pilot to describe the overall picture that he was faced with in a particular moment in time that could lead to a safety incident.

The CHAIRMAN. That is just a voluntary reporting system, and that is a little different than having a real time factual record of what actually occurred, I think. Rather than somebody's analysis of what occurred.

Mr. HOWELL. Yes, sir, and the second idea we have used within the association, with some success in the past, is to actually have a qualified observer on the jump seat, monitoring the flightcrew and its performance. I would like Captain LeRoy to respond with a little description of that effort, and to add anything more to that in response to the question.

Mr. LEROY. First, I would like to mention, as Jack said, the flight data recorder and the voice recorder are not the best way to obtain information. As a small example, I think I can say that probably a pilot, when he becomes completely saturated with the workload, will find that what happens to him is that his instrument scan goes to zero; he loses total comprehension of what is going on. He is not talking. There is no activity in the cockpit at all, and he is totally saturated—similar to what the military calls fixation—and he flies to the ground. Neither one of those recorders would detect any of that information.

There are things that can be gotten from these recorders; however, I think we are all aware of the chill that comes over a meeting of any kind when somebody pulls out a tape recorder and says: "Do you mind if I record this?" We are concerned about the effect on people in the cockpit if they know that they have to do two things: They have to fly the airplane, and save the passengers and themselves; and they also have to keep themselves straight on the flight recorder.

They don't feel that way now because they know that by regulation that recorder is to be used only during accident investigations, and they encourage that, and they embrace that, and they want that to happen.

But the problem is, if the FAA controls the access to that data, they have shown a history—although the regulation now requires that they only use that data, the voice recorder data, for accident investigation—they have attempted to gain that information from our airlines when there has been no accident. There was a recent case where they went all the way to a Federal court, and the Federal court denied them access to the information because of the regulation. And the statements in the past that they would only use it in accident investigation were completely ignored by the FAA in attempting to gain that information.

Our concern is that the FAA has shown a history of attempting to assess blame, rather than attempting to determine cause.

Now, if a proposal is made that that data be made available to some other body that can have an objective look at it, as is done in the ASRS program, as the NTSB does, we have no objection. We would welcome it. We would welcome the utilization of that data for those purposes by an independent body. We are not even sure that the FAA—if they detected what they considered to be a technical violation in looking at that data—would not even be obligated to file a violation against the pilot, because that is their responsibility.

It was mentioned that we have found better ways of getting this information, for example, in the joint evaluation between ALPA and United Airlines on the 737. For over 26,000 flight segments, trained observers were put in the airplane. These observers were trained by aviation psychologists, medical people, and they were told to look for certain kinds of things in the cockpit.

That data then was taken to other people, aviation psychologists, people of that nature, who reduced the data and made conclusions about the errors that were made in the cockpit; how they were made, who made them, and how they were corrected; traffic surveillance, who actually saw the traffic, and when evasive maneuvers were taken to avoid the traffic. And that information is available.

The FAA has never attempted to do any such program. That was done on airline aircraft in service, with passengers onboard. It's the only kind that has ever been done like that. We think if somebody really wants to know the answers to these questions, that is the kind of study that should be done, along with full mission simulations, so that you can take the aircraft, the simulated aircraft, into areas in which you would not be willing to subject flightcrews and passengers, as they do in all other kinds of certification tests.

That's the kinds of programs we are interested in seeing done to see the answer to this question finally answered.

The CHAIRMAN. What is ALPA's view of the proposed rule to take nonessential duties out of the crew workload, such as missed schedules, and rental car reservations, and things of that sort that we have heard about?

Mr. HOWELL. We agree that there is no place for that in the cockpit. If that information is required by the airline, and they wish to go to the expense, then the facilities for doing it should be back in the cabin with the onboard attendants. It is not a job for the cockpit crew.

The CHAIRMAN. Do controllers' slowdowns create additional safety problems for the pilots, in your opinions?

Mr. HOWELL. In my opinion, yes, sir. Any time you have congestion, you increase the frequency and the amount of radio transmissions that are needed; you increase the density of the aircraft in the terminal area; and those things lead to degradation of safety.

The CHAIRMAN. You notice support of the FAA's total simulation rule in your testimony. What is your view of the line-oriented flight training, the LOFT program that FAA described yesterday?

Mr. HOWELL. Well, there are at least three of us that would like to answer that. LOFT is terribly realistic. It presents a unique opportunity for the crew to be confronted with problems that they normally do not see in the flight training. Those problems can occur at rare moments, and the cost of safety, like liberty, is eternal vigilance. So it does have serious advantages.

There are also some disadvantages to the LOFT program over the basic simulator training program, in that when you first check out in an aircraft you are required to fly or perform some abnormal profiles which you may not again see in the LOFT program for a number of years. We are considering the idea of having the training program perhaps be LOFT, LOFT, LOFT, and then another kind of check, the overall initial checkout, and then revert back to the LOFT. So there is still a need for the original kind of training in addition to the LOFT program.

Mr. LEROY. We are so impressed with the LOFT-type training that that is why we use that as the basis for our recommendation to the FAA where the certification of the Super 80 should be done. We made a comprehensive recommendation to the FAA that that sort of scenario would be evaluated in certifying the cockpit in the same way that all of the other systems in the aircraft are certified. The cockpit is the only system that is not tested for failure, is not put in the most strenuous regimes, which it may encounter in actual line service in the whole airplane.

And with the LOFT program, you can do such a thing. The FAA gave us an economic answer to that proposal. They said you cannot hold up an airplane for a simulator, and if the manufacturer has not built a simulator at the time the aircraft is certified, we cannot require them to do so.

We think that an economic answer to a question like that is totally inappropriate. If simulation is the proper way to evaluate that cockpit, then simulation should be required.

Mr. HOWELL. John O'Brien has a comment.

Mr. O'BRIEN. There is one aspect of the LOFT program that was very intriguing to us when it first came on the scene several years ago at Northwest Airlines. One of the first things that Northwest found by using this training program was that the procedures that were used by the individual crewmen in certain abnormal situations could potentially conflict with each other.

And they found this out by integrating the total crew in the training scenario, rather than individually checking each member. This resulted in some changes to operational procedures on one airline that I know of, and probably could result in changes on other airlines if such a program were implemented.

The CHAIRMAN. Do you think the FAA should be moving faster to require state-of-the-art simulators and LOFT training for all flight crews? Or are we not moving as fast as we could be in the state-of-the-art simulators?

Mr. O'BRIEN. We have had several discussions with FAA and a few airlines and some simulator manufacturers on the subject. We have association policy that works toward a goal of total simulation training, with caveats attached to that.

We are talking about adequate simulators, of course. Right now, the simulator which would provide the capability for total training is not available. In the discussion with FAA on the subject, we felt that the rule that was just put out by FAA did not go quite far enough in requiring improvements in simulators.

I think, as Mr. Howell indicated in his statement earlier, that the technology can provide better simulators today. It is a question—we were given this point by FAA—it is a question of economics, again, a question of money: How much can we force the airlines to spend on new simulators now, immediately? And how much can they spend over the next several years to meet the goals of this program?

There is a tradeoff, the tradeoff is giving them the advantage of using the simulator to get out of the airplane, which is an economic advantage, versus requiring the use of new and more sophisticated simulators, which is an economic disadvantage. And again, we have the tradeoffs.

The CHAIRMAN. Turning to the crew complement issue, why hasn't ALPA petitioned to change the rule covering crew complement for transport aircraft, rather than fighting over every new aircraft certification?

Mr. O'BRIEN. Again, we have a situation where all three of us would like to add some points to this answer. I think I will try a couple and then let Mr. LeRoy answer the basic parts.

We think the present rule is indeed adequate. It is more than adequate, it is an excellent rule. The existing rule, coupled with appendix D, requires that all of the crew workload factors that we want to see examined be examined. In the existing certification process, this is not done. By regulation, the FAA is required to receive from the manufacturer documentation and data to show compliance with the existing rule.

Today, through the Freedom of Information requests that we have put in, we have not seen evidence of any documentation supplied to FAA to show compliance with FAR 25.1 part 1523 and appendix D. So it is not the rule that is at fault, it is a problem with FAA showing compliance with the existing rule. That is why we haven't petitioned for a rule change.

The CHAIRMAN. But if you actually had a rules proceedings and settled the issue once and for all, wouldn't that be better than having it come up every time you have got a potential two-pilot crew airplane?

Mr. LEROY. We are not sure that that is the proposal of the FAA. We heard Mr. Bond's statement yesterday, and we are not really sure what the proposal of the FAA is.

The CHAIRMAN. That wasn't FAA's proposal. That was my proposal. They indicated that it could be addressed in that fashion, but it was my suggestion that they go to a rule proceeding, rather than go this route. So if you have any question about what is intended by it, you could ask me.

Mr. LEROY. Well, if the proposal, either by you or by the FAA, is to settle this once and for all, we have concerns about the rulemaking process. We think the FAA has made some recommendations as to how to do this in another way, and we may be interested in agreeing with that proposal. The problems we have with the rulemaking process are explained by the experience we have had in the area of flight time/duty time rules.

Flight time/duty time is an area that we have been trying to get the FAA to address for many, many years. I am going to pass it back to John O'Brien and let him explain to you why the rulemaking process gives us so much problem with an issue such as this.

Mr. O'BRIEN. First, we will be willing to accept the program that would look at this issue and settle it once and for all. A proper program. Now, whether that would be accomplished through a rulemaking program or another type of program is still subject to debate. Our concern on the rulemaking process, basically, is captured in the scenario we went through on the flight time/duty time regulation and other regulations that somehow get bogged down in the FAA machinery.

In 1963, the FAA filed an advance notice of rulemaking for flight time/duty time. In 1964 an NPRM was issued, in 1971, several years after the 1964 issuance, the FAA withdrew its NPRM. In 1980, we had another NPRM come out.

Now, the process started in 1963 with the first advance notice of proposed rulemaking, and here we are in 1980 with an NPRM. We don't want to be caught in that kind of a situation on this particular issue. If we can have some kind of guarantee, a specific date by which this decision would be made, then maybe we could trust a rulemaking process.

But there are several other problems with the rulemaking process. Once a rulemaking process has been initiated, the comments have been submitted, by law the FAA can refuse to discuss the issue with any of the parties who submitted comments until the agency has reached a decision. This decisionmaking process can cover several years, as I just illustrated.

So beside from the fact that we think this can be done through other means, more proper means, than the rulemaking process, I think we have serious problems with that process.

Mr. **Howell.** Regarding whether we want to settle this once and for all, I call on Captain LeRoy for some additional remarks.

Mr. **LeRoy.** That is the problem we have with the NPRM route. But I understand, from what the FAA proposed yesterday and some questions you had of the FAA, there were some very interesting aspects of this issue brought out. They indicated they were scheduling a workshop during October, and they were going to discuss creating a task force to study this problem and to decide what kinds of tests should be done in order to decide the problem.

Now, that interests us. And the reason is the FAA, as far back as 1964, made a decision as to what the crew complement in small jets ought to be. The agency has had the same opinion and the same position ever since that time.

And it looks to us as though you would be putting them in a position of asking them to admit that they had been wrong since 1964 were they to say these aircraft ought to have a three-man crew.

Therefore, we think it is perhaps unfair to expect them to be completely objective about this issue.

Now, the task force that was conceived by either the FAA or you, were that to be appointed and were the appointment of that task force to be controlled in some way or guided by someone like this committee or someone who could ensure that the task force would not be FAA people and would not be people who rely on FAA grants for their program funding, whatever their agency is, totally objective scientists who would do the kinds of tests that need to be done and that can be done, that the state of the art allows to be done, in order to answer this question, then we would be for that.

However, the proposal we heard yesterday was that after the studies were done, including perhaps full mission simulation, including perhaps putting observers in aircraft and finding out what the real world is in air transport aviation, after this were done, an evidentiary hearing would held.

And in that public hearing, I believe, in answer to your question, Senator, it was indicated that the testimony in the position of witnesses would be subject to examination from other sides. So that testimony or opinion or allegation could be truly tested as evidence.

Now, the FAA, we understand, wants to then take all of that information after the studies, after the evidentiary hearings, and then go to the rulemaking process, which completely washes out all of the good aspects of the program to this point, because it can be carried out totally under the control of the FAA.

If the FAA is willing to say, at that point in time, that after a true evidentiary hearing and after studies done by a task force that is truly objective, that they will then say that the recommendations of that task force will be determinative of the issue, without going to an FAA NPRM process, then we think we can accept that program.

The **Chairman.** Senator Kassebaum.

Senator **Kassebaum**. We have a vote on, so I don't know how much longer I have to get into some of these questions.

That certainly sounds like a reasonable way to approach it. I think it is very difficult to find anybody totally objective on this issue, including the Air Line Pilot's Association.

However, you make a good point. I would like to go back briefly to your comment about past abuse in the use of voice recorders. Could you be more specific about what you feel has been abused there?

Mr. **Howell**. Specifically, what I was referring to was immediately after an accident, the voice tapes are put on national media. The crew members' individual comments, "Mom, I love you," or "Brace yourselves, this is going to hurt," that adds nothing to the determination of the accident cause.

Senator **Kassebaum**. I certainly agree with that.

Mr. **Howell**. There is no need for that. It does not convey information.

Senator **Kassebaum**. I certainly agree. It prejudices even the objective investigation that would follow.

The suggestion you have made, and which has evidently been practiced insofar as evaluation by air flight psychologists, and psychiatrists of the crew could be a very productive one in assessing crew complement problems and pressures.

Is the voice recording available to the NTSB, as well as to FAA? Or, is it just under the jurisdiction of the FAA?

Mr. **Howell**. You are correct.

Senator **Kassebaum**. Somebody said that he would have no objection if it could be shared with other groups as well.

Mr. **LeRoy**. The comment was that we are talking about a different use of voice recorders now, voice recorders not in an accident, carte blanche release or control, accessability to those voice recorders. We would want it to be controlled by someone other than the FAA.

Senator **Kassebaum**. I see.

The **Chairman**. We are in the second half of a vote. The committee will stand in recess long enough for us to vote and return.

[Recess.]

The **Chairman**. The committee will come to order.

With reference to ALPA's suggestion that we have a task force, let me ask you, if we had a task force, and they found that a three-man crew should be used on future transports, then FAA would still have to conduct a rulemaking to change the current rule, or keep fighting about every new airplane that comes along.

So, despite your mistrust of the FAA's rulemaking abilities, I don't see a way around their making a final decision by rule. Do you find a problem with that?

Mr. **O'Brien**. There is a possibility that one of the outcomes of the task force would be a recommendation that they should have three men. There's also a possibility that a task force could work and develop a methodology for testing that would be used during the certification process. This testing methodology could be employed on each individual aircraft in the future, like we have testing methodology for hydraulic systems, electric systems, and whatnot.

This gets back to one of the prime deficiencies that currently exists in the certification process. You have the rule, FAR part 25. 1523. You have appendix D. And then you have what is called the engineering flight test guide, which tells how you show you compliance with the rule.

Now, the methodology to show compliance with today's rule is nonexistent. So there is a possibility that the task force could develop test procedures that would show compliance with the existing rule, which in our opinion is adequate. That is one possible item the task force could work on.

But, as you indicated, another possible methodology they can employ would be to examine all of the pertinent factors that should be considered today and come up with a recommendation that, yes, all future cockpits should have three men. That, indeed, would be a rule change.

The CHAIRMAN. Of course, that authority could not be delegated to the task force. That is basically FAA's authority. They could designate a task force to do certain things, and the task force could come up with recommendations. But I don't think that FAA could delegate their authority to that extent under the law.

Let me ask you. Why doesn't anyone expert in aviation safety—that is, the NTSB, NASA, or the FAA—come out in support of ALPA's position on the crew complement?

Mr. O'BRIEN. Well, our position has been that the decision should be made through adequate testing in the certification process. This is the position we have advocated to the FAA on several occasions in writing. I guess you would probably have to ask the other individuals who would be party to such a decision why they haven't responded favorably to our suggestions.

The CHAIRMAN. Wouldn't a hearing—simulated test on the issue of the rule, in combination with Mr. Bond's announcement of aircraft certification reviews in the future for the DC-980, meet the objections of ALPA since you admit that two-men crews are safe today?

Mr. LEROY. Senator, the word "safe" is a very ambiguous word, because not even the FAA will tell us—and we won't tell them, because neither one of us know—how you measure safety.

If we knew, in other words, in what units you measure safety, we still wouldn't know how many of those units you would need to be "safe." That really is a meaningless word.

The only descriptions you can make about safety are comparative. You can say that one thing is safer than another, and we think it is the responsibility of the FAA to insist that the aircraft that we certify today are as safe as possible to make them. They disagree with that.

The FAA has told us, for instance, that the Super 80 will not have a fuel dump system which the regulation would require.

And we asked them why they wouldn't insist that it has a fuel dump system when the regulation requires it. They made this response. We don't have the authority to require the Super 80 to be safer than earlier DC-9's. From a comparative standpoint, we can say any aircraft that you build today, tomorrow, or in the past, if you build it with a properly organized three-man crew, it will be safer than the same aircraft built for a two-man crew.

That is why we know that they have the opportunity to build it with a three-man crew. We know they have the opportunity to test and determine that the three-man crew is safer than the two-man crew. So we will not be satisified with that certification until and unless they have done that testing to determine that the two-man crew is as safe as a three-man crew. Without that testing, they must err on the safe side.

The CHAIRMAN. Would it follow, from what you say, that a four-man crew would be safer than a three-man crew?

Mr. LEROY. We haven't tested a four-man crew.

What we say is this, Senator, we know that if the airplanes we are flying today did not have radar to detect thunderstorms, probably nobody would say that it is unsafe to fly without radar. But if you have radar, it is safer to fly with it. We know that.

Now, we have a standard that every aircraft that flies in thunderstorms has to have radar. We wouldn't accept anyone who said that radar was too expensive and we were going to take it out of the aircraft. In other words, measuring safety is a very perilous business. We are not willing to go backwards. And the traditional crew complement on turbojet aircraft in the United States is a three-man crew.

We don't see why you should do something less safe than what you are doing in most aircraft.

The CHAIRMAN. Does ALPA take the position that the workload for the normal flight of the DC–980 is not decreased over the DC-930?

Mr. O'BRIEN. Through our freedom of information request, we have gained a certain amount of information relative to the workload tests that were performed on the Super 80. Having reviewed the daily log sheets filled out by the test pilots who were involved in the east coast testing scenario intended to examine the operational variables of the airplane, we find serious inconsistencies between those daily log sheets and the summary reports turned in by the test pilots to show compliance with the regulation.

For example, on several occasions during these test flights that were conducted under ideal weather conditions, like today, under non-trying ATC situations, there were several violations of FAA regulations made by these test pilots. Altitude and air speed busts, missed callouts, missed traffic, misunderstood ATC clearances, all noted in the daily log sheets. These items would all be subject to FAA violation action if they had occurred during a regular flight.

Now, with that type of information on the daily log sheets for flights , which occurred during non-trying situations— admittedly described by the pilots as non-trying situations, because they said the workload never reached a serious situation—this illustrates, we believe that the cockpit of the Super 80 has not substantially reduced the workload. We believe that the data submitted by Douglas to the FAA does not substantiate the figure that we have heard tossed around of 40-percent reduction in crew workload. It does not substantiate it at all.

The CHAIRMAN. Is it your belief that the workload might increase because of system failures?

Some of these things that you mentioned are things that a third crewman has nothing to do with, wouldn't have anything to do with in the cockpit.

Mr. O'Brien. We have documentation to prove some of these things I have mentioned probably would have been caught by a third crew member, probably would never have occurred had there been a third crew member integrated into the cockpit.

We can look at specific instances that we are collecting now through surveying our membership. These are occurrences where a third man has caught exactly the type of item I am talking about, altitude, air speed, misunderstood ATC clearances, et cetera.

Also, it is interesting to note, as a sideline, that if you look at the violations that actually have been pursued by FAA and compare the two-man operation with the three-man operation, there is a significantly higher number of violations against two-man crews for missed ATC clearances, for example. We think there may be a direct correlation between that and workload.

Also, through the ASRS program, there has been a study on distractions in the cockpit. I think a review of that study would show a close correlation to the trend that is indicated in FAA violation history.

Now, all of these things, taken in toto lead us to believe that what is now accomplished in the FAA certification process does not truly address the workload items which are present in the regular line operations. And we think they need to be addressed before an airline aircraft is certificated.

The Chairman. Altitude deviations are a prime factor in a number of the accidents classified as pilot error. Has ALPA made any recommendations on how the FAA might reinforce the pilot's attention to altitude? And let me ask you one further question in connection with that. Does a third man in the cockpit call attention to the pilot and the first officer that they have deviated from the altitude? Is that normal procedure?

Mr. LeRoy. Absolutely. And that is the kind of information that was determined by a study called In-Flight Procedures in the ALPA evaluation of the 737 actual line operation. That is the kind of violation that is found when the second officer notices the deviations from ATC clearances.

The data that Mr. O'Brien has just mentioned confirmed the FAA data that the three-man crew makes fewer of those kinds of excursions than a two-man crew.

The Chairman. What about the first part of my question? I said, has ALPA made any recommendations on how the FAA might reinforce the pilot's attention to altitude.

Mr. O'Brien. On the second part of the first question and then the first part, I think Mr. Edmunds has some specific numbers on the value contribution of the third man.

Mr. Edmunds. Senator, when we looked over the results of the questionnaires that had been sent back to us, out of 700 questionnaires that we looked at so far, we could identify approximately 448 specific instances where the second officer was making a substantial contribution to safety. It was rather surprising that of those 448, 205 of those occurrences where when the second officer was credited with averting a near midair collision. Some of them give the miss distance very specifically in the encounter between the two aircraft.

Other areas that were mentioned in this questionnaire was where the second officer was cross-checking procedures and relieving workload for the pilots, primarily during emergency operations and also alerting them to a dangerous situation that was developing.

So we feel that certainly, on the basis of the questionnaire information that we've received so far, even though it is in a preliminary form, the second officer has made a substantial contribution to safety.

The CHAIRMAN. I have here a sheet from Aviation Daily dated August 20. I would like to ask you a question concerning a quote to Mr. O'Donnell and ask if you if, in fact, Mr. O'Donnell did make that statement, if you know.

This is the quote:

> When Baumgartner questioned the possible union media attack on an airplane that might eventually be flown by any member of this Association, O'Donnell responded in point-blank fashion, "You should be under no illusion, under no illusion that if the FAA does not certificate these DC-980s with a three-man crew"——

and I said this off the record yesterday, so you understand it today—

> I am going to do everything within my power to destroy that aircraft. You should understand that. Whatever I have to do in the media, whatever I have to do in the courts or the U.S. Congress, I am going to do everything to get that aircraft certificated with three pilots.

Is that a correct quote from Mr. O'Donnell?

Mr. LEROY. Yes; I think that is a correct quote. Perhaps that is part of the reason we are here today, Senator. We are the people who have to spend our lives in those cockpits. The people we are representing feel strongly that those aircraft should be flown with three-man crews, so we are going to be here. We are going to be talking to you. We are in the courts.

If an airplane is certified for two, and airlines buy them and put them on the property, we are going to recommend to the pilots that they don't fly them. And if the pilots don't fly them, that is going to destroy the aircraft.

We don't want to do that. We don't want to destroy Douglas Aircraft Co. We think there ought to be three manufacturers in this country to provide the kinds of competition that give us the best tools we can have to fulfill our responsibility to the traveling public, but we will do everything we can to make sure that that aircraft is certified for properly operating three-man crews.

The CHAIRMAN. How do you explain your rationale for not taking that type of an action on the 737 or the smaller DC-9, the DC-930 for example?

Mr. LEROY. Well, we didn't know then what we know now, Senator. As a matter of fact, we didn't know that the decisionmaking process back then was based on economics. At that time, we didn't have access, because it was denied to us as proprietary information, to all the correspondence that went on in certification of the original DC-9. Now, through the Freedom of Information Act, we have received some of that correspondence. We find, for instance, that in an FAA engineering manufacturing memorandum dated March 24, 1964, the FAA western region, in this correspondence to headquarters here in Washington, said that in order to enable Douglas to compete in a sales race between the DC-9 and the BAC 1-11, "Douglas has requested some assurance in writing from FAA to the effect that they would be able to deliver DC-9's with a crew of two at weights in excess of 80,000 pounds."

Now we didn't know that economics was the basis of the decision, and we have been told since then that there was comprehensive flight testing. We found out later that the original DC-9's cockpit certification was based on one flight—one VFR and one IFR approach.

At that time, we thought we had full faith and confidence that the FAA was fulfilling its responsibility in the certification area and doing an adequate job. We find now that they were not. We didn't at that time have the benefit of congressional committee reports and GAO reports saying that the FAA is not able to fulfill its responsibility. And we finally decided if they won't, then we will.

The CHAIRMAN. How do you respond to the statistics that show that the two-man airplane is a safe airplane?

Mr. LEROY. That it is a safe airplane?

The CHAIRMAN. Yes.

Mr. LEROY. I just explained to you that "safe" is a hard word to work with. Now, I tell you what one manufacturer has claimed. They have said that they can show conclusively by statistics that the two-man airplane is safer than a three-man aircraft. That is the kind of relative judgment that we can deal with, and we can deal with those statistics in very short order, because they are totally and absolutely worthless. They do not show what they purport to show, and we have pretty comprehensive analyses of those data we can provide for you.

The CHAIRMAN. They don't show that the two-man airplane is less safe, do they?

Mr. LEROY. What they show, Senator, and what the FAA statisticians indicated that they showed, is that fortunately air transportation in this country is so safe that we have very few accidents. If you try to make a comparison between aircraft types to determine the difference in crew complement, the statistics are not of the type that allow you to make any determination. They don't say there is no significant difference. They say the significance is such that you can't tell whether there is a difference.

The CHAIRMAN. If you say the statistics are such that you can't make a determination, why does ALPA take the position that they will go out to destroy an airplane.

Mr. LEROY. Because the FAA never has made decisions on certification on the basis of statistics. I know of no statistics that say aircraft with multiple hydraulic systems have fewer accidents than those with single systems. But the FAA requires that you have redundancy. You don't make decisions on air safety on accident statistics, because most statisticians will tell you that you just can't make those decisions that way. There are other ways to do it.

We have outlined ways that it should be done. We have asked the FAA to do it those ways. We think we have been as reasonable and responsible as we could be, using proper scientific methods to ask, "Why don't you do this? Why don't you find out the answer to the question?" And we have been rebuffed.

The CHAIRMAN. You, too, have overwhelming statistics to support your position for a position as strong as this that you take?

Mr. LEROY. We have some pretty overwhelming statistics on the 737 evaluation. We found that there are some very convincing data that show the second officer makes a significant contribution to the operation of the aircraft. It not only convinced us, but it convinced six of the most eminent arbitrators in the United States from the National Academy of Arbitrators—purely objective people who were agreed to beforehand by both parties. So there is data that shows it, yes, Senator.

The CHAIRMAN. Senator Kassebaum?

Senator KASSEBAUM. I think in all fairness, though, that you would have to acknowledge that you have an interest in the economics as well in this decision. Just pointing to the fact that the airlines do not weigh it out fairly.

Would you agree that if an independent panel makes a recommendation that, indeed two pilots would be adequate and safe, you would be supportive of that decision.

Mr. LEROY. I think if the proper kinds of tests are done by the proper kinds of objective parties and a detailed study is done, I think there is no way that we could avoid taking that position. If we agree with the program, as we have said we would here, then we would have to agree with the results.

I would have to say with all due respect that it has never been adequately explained to me what economic interest I have and my company has having to hire people who are junior to me. You will never have any effect on my seniority or upon my pay raise. As a matter of fact, the airlines have insisted on three-man crews. The pilots that are flying those aircraft are getting significantly lower pay rates than the pilots who have agreed to go along with two-man crews. So exactly the opposite is true.

From the standpoint of the airline pilot, there is an economic advantage to flying with a two-man crew. It can be demonstrated. One airline that agreed to fly a DC-9 with two-man crews has rates comparable to DC-10 wide-body aircraft on other airlines, so it's not true that we have any economic interest at all in this issue. It is a safety issue.

Senator KASSEBAUM. I would think that airlines would have a major safety concern as well, because they are the ones who would be responsible if there is an accident. They have to be terribly concerned about the safety in that plane. In the long run, it would be far more economically feasible for them to have three pilots if safety is a consideration, rather than just two.

Mr. LEROY. Well, there are major airlines that only fly with three-man crews. Beyond that, we think we could get some good economic analyses together. We haven't done it, and we don't have the competency or the resources to do it, but we think we could show pretty well that a three-man crew has some very definite economic advantages for the companies.

Unfortunately, those economic advantages can only be demonstrated by people who have a pretty good understanding of the flight operation, and our airlines really are not run by pilots. If you don't understand the economic advantages, you may not realize that they exist.

Senator **Kassebaum**. It would seem important that somewhere along the line that somebody develop some confidence in whatever decision is made. It is unfortunate that there isn't that confidence in the FAA because they certainly, it would seem to me, would be an agency that would attempt to be independent in their evaluation for the sake of the excellent aviation safety record that we have in this country.

Mr. **LeRoy**. It is the only game in town when it comes to certifying aircraft. They are the people, in the final analysis, that we will have to rely upon to make these decisions. However, we also know that the Congress, in its wisdom, has set up organizations to maintain oversight of what the FAA does.

What we are saying is that we think the FAA and the industry need help in seeing that the FAA does this correctly. Ultimately, they will be the ones who have to do it right, and we think that somebody is going to have to make them do it right. We are hoping to get that kind of help from you.

Senator **Kassebaum**. Thank you very much. I have two other brief questions.

You indicate in your testimony that New York and Chicago air route traffic control centers have severe weather avoidance plans, but they do not tell the pilots about them. I wonder why not? Why is this information not better coordinated?

Mr. **Howell**. I don't know, but it is absolutely correct. Most of the time when we receive the information about the severe weather avoidance program, it is merely to take the delay at the gate for 45 minutes.

What we see happening is the crew is not being able to get the information about the routes they are going to fly. We have a very good weather radar system on the aircraft, and that allows us to look ahead for 200 miles. But the procedures that are in effect actually allow the air traffic control centers to dictate what routes we can fly without our being aware of the actual conditions along that route.

Weather systems are variable. They move during the time that one lifts off from Fort Lauderdale until he comes ashore at North Carolina in the Wilmington area. There can be significant changes in the weather patterns that we can use.

Senator **Kassebaum**. Do you think it would be beneficial to have the controllers more directly involved in assisting with the weather decisions?

Mr. **Howell**. The big complaint our association has is that we don't get enough information into the cockpit. We look forward to the time when we can perhaps have the data link from the DABS system which is on the horizon providing us with what may even be hard copy of weather reports along the route.

Senator **Kassebaum**. In your opinion, was the cause of the delay in handling traffic last Friday at O'Hare due to a work slowdown? What do you think might have been the cause for that delay?

Mr. **Howell**. It may have been due to that, yes.

Senator **Kassebaum**. Do you have any other thoughts on what might have caused it?

Mr. **LeRoy**. No; I do not.

I was traveling as a passenger, not on that day but on a very close day. The pilot of the aircraft we were on indicated there was a traffic slowdown and that is why we had a 2-hour delay. And when we got on the ground, he came back on and said that wasn't the case; there were severe thunderstorms in the area and that had slowed the traffic down. He apologized.

Senator **Kassebaum**. Around O'Hare on that day.

Mr. **LeRoy**. A day just before or after.

Senator **Kassebaum**. Did the pilots give any indication of what their opinion was about the trouble on the 15th?

Mr. **Howell**. I have no information on that specific date. I would be happy to research and submit it, if you wish. I am sorry that I am not personally familiar with the conditions on the 15th.

Senator **Kassebaum**. Thank you very much.

Senator **Exon**. I would like to pursue this matter of the two- and three-man crews a little bit with you gentlemen. Bear in mind that I am not a pilot; I have never flown an airplane, fortunately for myself and those who might be on an airplane with me. But I have high regard for you professionals who do a tremendous job, in my opinion.

Now we are getting back to the two- and three-man crew situation. I have flown as a passenger on numerous occasions on Lear jets. I believe it is true that FAA requirements require two pilots on a Lear jet; is that correct?

Mr. **Howell**. Yes, sir.

Senator **Exon**. That is a very small airplane compared with the large airplanes you fly, especially the DC-9 and what I understand to be the DC-980, which is a stretch of the DC-9. I guess as a layman I am trying to reconcile in my own mind how it is reasonable from a safety standpoint to require two pilots on a Lear jet and still only two pilots on a very large aircraft which, I assume, is much more complicated as far as controls and things of this matter are concerned.

Mr. **LeRoy**. That is a good question. We feel that it is not the size of the aircraft that makes the difference as to what the crew size should be; it is the level of safety that you expect. The FAA has different requirements for scheduled air carriers operating under part 121 of the FAR than they do for other operations.

Now, your operation of the Learjet was probably under part 135. There are lots of things, safety requirements, that scheduled air carriers are required to have, such as dispatchers. There are many, many requirements that a part 121 operator is required to meet, and one of them, we think, should be a three-man crew. We think it doesn't make any difference about the size of the aircraft; if you get on a scheduled air carrier, you have a right to a certain level of safety, and that level of safety includes fire protection, radar, dispatchers, and a properly integrated three-man crew.

Senator **Exon**. I am advised, for the correction of the record, by staff that a Learjet can be flown legally with one pilot. Did I misunderstood you to answer the question? I thought you confirmed my probably mistaken belief that you were required to have two pilots on a Learjet.

Mr. LeRoy. It depends upon the type of operation, Senator. You can fly a Learjet with one person, I believe, in a private operation. I don't know what a part 135 operation, a charter-type operation, would require. But that just points out that different types of operations have different levels of safety.

If you are required to have all of these things under the part 121 operation, is the part 135 operation "unsafe," because you couldn't conduct those operations under 121? The answer to that—and the FAA would give you the same answer—is that there is a different level of safety, different safety requirements. But if you get on a scheduled air carrier, you have learned to expect a certain level of safety; you expect to have all of those things that you don't expect on a charter or on a commuter.

Senator Exon. I have never knowingly traveled on a Learjet with only one pilot. I hope I never have. I just happen to feel that I need two pilots on an airplane like that.

Senator Kassebaum. Mr. Chairman, if you would yield, I would like to say the manufacturer is in Wichita, Kans.

Senator Exon. I know where they are manufactured. I think they are a pretty good airplane, though—since you brought it up—despite the adverse publicity that they are receiving right at this time.

Mr. LeRoy. If I could add something to that. The problems that we have with the FAA with respect to crew complement are somewhat pointed out by the intuitive remark you made that you thought the Learjet should have two pilots. Basically, the reason it needs two pilots is not so much the systems in the airplane; it is the environment, the speed at which it operates in the environment. The FAA has certified similar airplanes, such as the Citation SP, for a single pilot. Believe me, if you get in one of those aircraft, you may very well have a single pilot. We think if the FAA can make that mistake, it is just the same kind of mistake they are making with respect to our operations. They are not really evaluating the situation in the way that they ought to be.

Senator Exon. Again, speaking as a layman, what does the third pilot do on aircraft that now require three pilots? Is he basically the backup check on the—with the individual on the left and right seat?

Mr. LeRoy. You said on aircraft that do not require three-man crews?

Senator Exon. Aircraft that do require three-man crews, what does the third—he doesn't have any controls or anything—what does he do?

Mr. LeRoy. Basically, Senator, he does everything that is not directly involved with manipulating the controls, navigating the aircraft, and communicating with ATC. In other words, just that job, flying the aircraft, maintaining the navigation and communication——

Senator Exon. Is a two-man job?

Mr. LeRoy. That's right. And he does everything else. He operates the systems, but the systems operation has become much less important, compared to the old prop aircraft. He is totally involved in the operation of the aircraft. He does operate the systems. He does monitor the systems. He does monitor the other two pilots on our category 2 approaches. The second officer is supposed to set up his panel so that it operates and can go without being monitored for a few minutes, and direct his entire attention to monitoring the two pilots who are flying the approach.

As a matter of fact, in my airline, he has the approach plate that charts all of the altitudes and headings that you use. Obviously, he is not flying the airplane, but he does have the navigational chart in front of him because he monitors to make sure that the other two are leveling out at the altitudes they are supposed to and taking the headings they are supposed to.

With the kind of approaches we are shooting nowadays, it becomes very critical. You cannot let a mistake go for very long. He takes care of all of the communications with the company, communications not only on passenger accommodations, but also on maintenance problems. If we have a maintenance problem, we have a man there that can talk to the maintenance department and tell us how best to operate the aircraft with that particular problem, or perhaps how to alleviate the problem or to have a part waiting for us when we get on the ground.

He takes care of the problems with the cabin crew. We have had, unfortunately, in the past 2 years a great increase in the number of disturbances in the cabin. And when you have somebody back there beating on a flight attendant with a bottle, somebody has got to go back there and try to arrest the situation. And if you only have two people, that is one of the pilots.

Senator EXON. Let me interrupt here. With men taking over more and more as flight attendants, can they take care of themselves back there, or are you saying that you have to go back there to help the female flight attendants?

Mr. LEROY. Very seldom does a pilot go back, that he gets in a physical altercation with a passenger even though there is one going on when he gets there. And the reason is—and you may smile—he has his hat on. He is a symbol of authority, and we are told never to go back to the cabin in an instance like that without your hat on. When you go back there with that symbol of authority, things usually settle down quickly. The pilot does have an authority that the cabin crew do not.

Senator EXON. I interrupted you. I am sorry.

Mr. LEROY. In the case of our unusual situation, where we have a mechanical problem, when we have an emergency, the second officer is used to a great extent for troubleshooting. He has a manual; he can pull it out and see what is going wrong with that airplane: Why did the light come on; what equipment do we have left after we have lost that system?

There are some very complicated procedures that we have to go through, some complicated systems with respect to flight controls and so forth. It is important that you go through these troubleshooting procedures before you try to put the airplane on the ground. He assists in that.

Basically, with respect to collision avoidance, the second officer does everything that the two pilots shouldn't really have to divert their attention to. So what that does is allow them to look outside the cockpit. One thing we found in our evaulation back in 1968 is that on some approaches and climbouts, as much as 50 percent of the time, nobody was looking outside the cockpit. That is at an altitude of about 15,000 feet. With a two-man crew, no one is looking outside the cockpit.

That seems shocking, but if you talk to the crewmembers and ask them what they have to do during that period of time and realize that one is flying the noise-abatement procedure, he has to fly at a slower speed and follow the routing, the other man has to make navigational and communications radio changes. It is easy to understand there is a long period of time when neither one of those people is looking outside the cockpit.

We never made a claim that the third man is there to see traffic because the manufacturers have made it clear he can't see as well as the two pilots. We recognize he is sitting further back and has a more limited visual field outside the cockpit. What we have said is he is there to alleviate the two pilots of all the duties he can, and he still sees about 30 percent of the traffic.

Perhaps the visual field he has is more critical where the airplane will actually travel. But the fact that is borne out by the data is that the second officer sees a significant portion of the traffic. The three-man crew sees more traffic that is not called to its attention by the ATC than a two-man crew does. If you see the traffic, very rarely do you hit it.

Senator **Exon**. I am sure this is a very unscientific question from a very unscientific mind. But it has always disturbed me when I have flown in the copilot's seat, which I have frequently in aircraft coming into congested traffic areas, that it is very difficult to see other aircraft. I have taken a little training from experienced pilots on how to spot and so forth. I have often wondered why we have not developed a system where there wouldn't be one crewmember, whoever that crewmember is—I don't say that this crewmember would have to be a fully certified pilot—but coming into a congested area, why is there not visual—periscopes or something—that would give someone the prime responsibility for looking at least above and below and straight ahead on aircraft?

Is it not a major concern to you as pilots that you can't see very well out of the cockpits? Have you ever tried or suggested the idea that you should have some auxiliary visual assistance bringing in these monsters into crowded air conditions?

Mr. **Howell**. That is of grave concern to us. We have spent a lot of time studying techniques on how to scan properly, moving the head, moving the eyes, trying to not have the eyes focus on the bug on the windshield rather than the aircraft against the city background.

There are means to increase the conspicuity of the aircraft, which is a fancy word of making the aircraft show up better in the field of view. But beyond that, we have long advocated the introduction of a device in the cockpit to provide us with information about the traffic that immediately surrounds us. In recent times, it was called the "traffic situation display." Now I think it is called the "cockpit display of traffic information."

And what is envisioned there is simply a repeater scope of the surveillance information which serves as the data base for the controller's scope on the ground. If we could have part of that information selectively sent to our cockpit, it would help us a great deal in seeing and avoiding the traffic in our immediate vicinity.

Senator EXON. What objections have you run into with regard to improving that? Cost?

Mr. HOWELL. Cost.

Senator EXON. Is the technology available?

Mr. HOWELL. The technology appears to be available. In recent times, I think I would admit that it has not been. In early times, the process involved broadcasting a televised picture of the radar scope to the cockpit; that was one possibility that was explored. Onboard traffic radar detection devices have been explored. But we seem to be at the point in technology where, again, the system, with its data link, may be able to support the display of traffic information into the cockpit. So we as an association are looking to the DABS program to provide us with that.

Mr. LEROY. Since we do not have that, we do not have collision avoidance systems. Mr. Bond himself has testified on see-and-avoid; he has termed it the "touchstone" of our ATC system, the ability of pilots to see the other traffic. We recently sent out a questionnaire to our pilots that asked them to send us instances where the second officer has provided assistance. A significant portion have been signed statements from captains that say the second officer prevented collisions between his airplane and another airplane, and had the second officer not been there and called our attention to the other aircraft, there would have been a collision.

We have authenticated these statements with names, dates and places. That is why we say the third man makes a significant contribution to the safety of our operation in that area.

Mr. BARCLAY. If that is accurate, then why don't we see in the statistics that there have been more accidents? Why does the statistical base show how safe two-man crews flying millions of hours have been?

You would think that, with the lack of that third crewmember, not catching these things, it would have caused accidents. The statistics don't bear it out. The statistics are based on accidents. That is simply too small to get, to draw any conclusions from it, on two versus three.

But the statistical basis on safety is overwhelming. It shows that both are very safe.

Mr. LEROY. We talked about the data that the FAA had produced and Boeing had used in making the two-man, three-man comparison. We point out that the FAA said in order to look at that kind of data and make a comparison, you had to normalize it.

The FAA did that in a strange way. When they looked at accidents that could be reasonably attributed to the flightcrew they included accidents such as a flight attendant falling down and breaking her arm or a person going to the lavatory, going back, falling down and breaking his arm; a young lady seating her elderly mother in a flight attendant jump seat, falling down and hurting herself. In other words, all of these had nothing to do with flight through air.

So, we had our people look at only those accidents that the NTSB attributed as a probable cause or a contributing factor of flight through air.

Now, when you get down to that small a data base, the statistician says you cannot state with confidence that you can make comparisons. What the numbers show is not statistically significant.

You have not seen us using that data, because we know, as you know, that they are not statistically significant. There are more flight-through-air accidents on two-man aircraft than on three-man. And not too long ago the two-man aircraft had by far the record for midair collisions.

Mr. **Barclay**. You are arguing safety, Mr. LeRoy. And what is statistically proven is that both are extremely safe and that the differences between the two, as far as being safe, you can't make a statistical case that one is safer than the other.

Mr. **LeRoy**. Because you cannot make a statistical case does not mean that it is not a fact. We are saying it is a fact that the three-man crew is safer than two. But there are many things that you can't tell by statistics. You can't statistically prove that you, or I, or anyone else married the right woman. You may be absolutely confident that that is the case, but you can't prove it by statistics.

Mr. **Barclay**. I'm not married.

Mr. **LeRoy**. I'm glad that's the case. I could have gotten in trouble, I suppose. But there are many things that you can't prove by statistics, and this is one of them.

The way you do prove it is to look at individual cases, and you find out it is a fact. In certain, specific circumstances, the second officer makes a significant contribution to the safety of the operation. If that is the case, we think three should be required.

Senator **Exon**. Will the DC-980 land at Washington National?

Mr. **LeRoy**. If it has a three-man crew, it certainly will. We suspect it will land at Washington.

They have had to increase the runway length that the aircraft will be certified to operate under because of an accident. We don't have the data on what happened on the accident, but my understanding is they have increased the runway length requirements for the aircraft. I don't know what they are, but I would suspect it will be able to land at National.

Senator **Exon**. My point is, is not Washington National, the runway's location, the length of it one of the areas where you would emphasize the case for the three-man crew?

Mr. **LeRoy**. Washington National Airport is one of the kinds of airports in which the third man becomes very useful because there is a great deal of traffic there and there are special ATC procedures that we must follow at this airport.

Yes, I would say that the need for the third man crew will be seen as strongly at National as at any airport.

Senator **Exon**. I am surprised you haven't made that point before. I was assisting you in making the point.

Mr. **LeRoy**. I see.

Senator **Exon**. There will be some people who will be voting on this, probably sometime in the future, who have a special consideration around Washington National Airport.

Mr. **LeRoy**. Since you bring it up, Senator, I would just like to mention that we are concerned with a great deal more than crew complement. We are concerned about the entire certification of the Super 80 and other aircraft.

An example of the things that we have brought to the attention of the FAA recently and in the past is that last year four DC-9's taking off from Dulles Airport had engine failures due to slush congestion. That was not at National, that was at Dulles. We think it would be incumbent on the FAA to do some pretty serious testing of slush ingestion for the Super 80's. The entire slush ingestion test for the Super 80 consisted of operation through standing water for three-quarters of a second during takeoff.

Now, we brought it to the attention of the FAA that three-quarters of a second does not in any way simulate the kind of ingestion problems that aircraft is going to have when it takes off on a water-covered runway. They did absolutely no slush ingestion tests on water-covered runways. We think that is where the certification was inadequate.

Senator **Exon**. You seem concerned about the DC-9 and the safety aspects thereof, which is naturally of concern to us. There are other commercial airliners that are certified with two-man crews.

It seems a little inconsistent to me that you, as an organization, are not saying that you could have three-man crews on all aircraft. Is there an explanation for what appears to me to be an inconsistency in your position?

Mr. **LeRoy**. It does appear to be an inconsistency. I can only tell you that the Air Line Pilots Association itself has never had any position on any large transport aircraft other than it should be provided with a three-man crew. That has always been our position.

We fly airplanes for a living. We didn't get involved in the certification.

As I said earlier, when the original DC-9 and BAC 1-11 came out, we had more respect for the FAA certification process than we do now. We also didn't have any experience with jet aircraft with two-man crews. Those were the first ones we had.

When the 737 came along, as you have seen, ALPA, in concert with the first U.S. airline user, got into a very deep and exhaustive evaluation of that aircraft. We were very concerned about the crew complement in that aircraft.

On United, we settled the matter, and it has stayed settled.

In 1974, the president of the Douglas Aircraft Co. came to our board of directors meeting and told us, categorically, that Douglas had no plans to build another two-man-crew DC-9. We believed him. And he did it anyway. That is why we are here because we made it clear in 1974 we were not going to countenance any more two-man aircraft unless somebody did some pretty exhaustive tests and could show us it was as safe as a three-man aircraft. They refused to do the tests because we believe they don't want to know the answer.

They came up with another two-man airplane. And we have taken the strong position that we have taken.

Senator **Exon**. If the FAA had decided that you needed three—I'll ask the question another way.

If the FAA had decided that you needed three-man crews on the DC-9, the DC-980, as I understand it is called, then would they not have been in a position of requiring three crews on all commercial aircraft?

Mr. LeRoy. I don't think so, Senator.

Ideally, the way we understand it, when a new aircraft comes out to be certified, it is certified to more stringent requirements than previous aircraft. Previous aircraft that are flying today—727's, DC-10's, L-1011's, 747's, DC-6's—could probably not be certified to today's requirements.

One reason is the state of the art has changed. Another reason is probably because the environment has changed. The Super 80 will fly in the next century. It will be in a totally different environment than the DC-9 that first flew back in 1965. It will be in a different environment than we have today, and we think that environment will even more seriously require that third man.

It has never been our position that new requirements for new airplanes have to be retroactive to all the other airplanes. Business is not done that way.

Senator Exon. I want to pursue one last question on another subject. I don't know whether it was touched on in any depth or not, but yesterday we had very sharp, conflicting testimony from the FAA and the controllers' union with regard to the present computer system, the controllers' union claiming it was obsolete and dangerous, very sharp, very opposing points of view.

As pilots who have to fly these airplanes, do you tend to side with the stand taken by the controllers on their position that the FAA is not insisting on the latest computer networks to provide air safety? Or do you tend to side with the FAA, that the present system is adequate?

Mr. O'Brien. We have provided testimony on the subject before other congressional committees. To summarize briefly, I think we have indicated a concern over the computer capabilities in certain FAA facilities. There are different levels of sophistication and new technology involved.

In general, the en route facilities have the older equipment, and that is where there are more breakdowns. We have encouraged the FAA to move as rapidly as possible with implementation of the new system. We know that this is a long way off, and we are concerned—we are very concerned—over the computer breakdowns. It does cause a problem with safety, and we have not seen any near-term solution to this problem.

Senator Exon. Do any of the rest of you care to comment on that?

Mr. Howell. This is one of the additional reasons why we have long been pushing for an independent collision-avoidance system, independent of the primary surveillance net that the controllers use for traffic separation.

Senator Exon. Gentlemen, thank you very much.

If there are any further questions—Senator Kassebaum?

Senator Kassebaum. No.

The Chairman. We appreciate your coming and giving us the expert testimony that we received.

Mr. Howell. Thank you, sir. We appreciate the opportunity.

The **CHAIRMAN**. You are excused.

[The statement follows:]

STATEMENT OF THE AIR LINE PILOTS ASSOCIATION

Good morning, Mr. Chairman and members of the Subcommittee. I am Jack Howell, Executive Central Air Safety Chairman of the Air Line Pilots Association (ALPA). With me today are John LeRoy, who is Chairman of both the ALPA and IFALPA Working Groups on Crew Complement, and John O'Brien, Manager of Engineering and Operations in ALPA's Engineering and Air Safety Department.

On behalf of the 33,000 members of ALPA who fly for 31 airlines, we are grateful for this opportunity to present our views on what can be done to improve airline safety. We are also pleased that the Subcommittee has taken the initiative in these hearings by placing special emphasis on the role of human factors in airline accidents. We believe the issue of human factors in airline aviation has not received the attention it should from various federal agencies, and we hope these hearings will lead to more research on human factors.

We in ALPA believe such research has been sorely needed for a long time. Human factors are involved in the majority of aviation accidents—anywhere from 60 to 90 percent of all accidents, according to various studies. Thus, it is clear that human factors in general are the biggest issue in aviation safety today.

Therefore, we are puzzled—and have been for many years—that human factors have not received more in-depth attention from accident investigators and others involved with aviation safety. Too often, the cause of an airline accident has been attributed merely to "pilot error" with little effort made to determine why the pilot made the error.

Was it due to inadequate training, fatigue, preoccupation with other matters, or poor coordination among the crew members? Or did other factors such as cockpit instruments and design, misunderstood instructions from an air traffic controller or visual illusions contribute to causing the accident?

In most accidents, it is not just one human factor but a combination of elements that contributed to pilot error. That, of course, makes it more difficult for accident investigators to pin down all the underlying causes that contributed to pilot error. Nevertheless, we believe much more effort needs to be made to determine why human errors are made in airline accidents.

Intense efforts are commonly made to determine in minute detail the causes of mechanical failures. For example, an engine that failed will be completely disassembled and every part inspected in detail in an intense effort to determine why the failure occurred.

We can only conjecture why much more emphasis is placed on determining the causes of mechanical failure rather than human error. It may be that accident investigators, with their technical backgrounds, are more comfortable dealing with the tangibles of mechanical failure rather than probing factors that may have led to degradation of pilot performance.

Another element that tends to work against further exploration of human factors in airline accidents is the tendency to devise equipment that will help prevent human errors without making any real effort to understand what factors are causing the human errors. That is treating the symptoms but not the causes and is similar to taking an aspirin. Your headache will go away, but there will be no effect on the brain tumor that is causing the headache.

Let me provide an example. In the late 1960's and early 1970's, a major safety problem in airline aviation was controlled flight into terrain (CFIT). The aircraft, strictly through pilot error and without mechanical problems, flew into the ground and crashed. After repeated recommendations from the National Transportation Safety Board and a 1974 crash west of Dulles International Airport, the Federal Aviation Administration required all airline aircraft to have a ground proximity warning system (GPWS) installed.

The GPWS provides warnings to the cockpit flight crew if the aircraft is descending too quickly, is too close to the ground, is in the wrong configuration, etc. The GPWS has been quite successful in reducing the number of CFIT accidents, but it has done nothing to address the underlying problem: why do such deviations from the normal flight path occur?

To answer that question, we need more research on approach procedures, crew coordination and workload management, and pilot decision-making at low altitude in poor visibility. That research, and other work in human factors, would be a major contribution toward preventing accidents such as the one two years ago where a crewmember responded to the GPWS warning by turning off the system shortly before the aircraft landed short of the runway.

That accident and other recent ones clearly demonstrate that we need more emphasis on human factors in accident investigations. This added emphasis is needed not only to uncover information that will enable us to prevent similar accidents from occurring in the future. Such emphasis is also needed to determine basic truths involving human factors that will be applicable not just to specific types of accidents but to many other facets of airline aviation as well.

While we clearly see a need for more human factors work in accident investigations, we also point out that accident investigations are not the best source of information on human factors problems in airline aviation. Reports of these investigations show only what has happened and usually do not indicate the current level of safety conditions in the airline industry or what problems might arise in the future.

A far better source of information is reports of near-accidents and incidents. These can detect potential trouble spots and show trends in airline safety as they develop. One reason that these reports are more valuable than those on accidents is that the former are much more numerous. Another is that those making the reports are available to provide additional information.

ALPA believes that we and everyone else in American aviation are very fortunate to have the Aviation Safety Reporting System, which is run by the National Aeronautics and Space Administration. As the Subcommittee knows, ASRS encourages pilots, controllers and others to report conditions and incidents that affect aviation safety. In collecting and analyzing these reports, ASRS provides volumes of useful and timely information on the day-to-day operations of our national airspace system.

It is still hard for us to believe that the FAA attempted just last year to unilaterally dismantle the ASRS. Fortunately, ALPA and virtually every other group in aviation strongly protested the FAA's move. With the considerable assistance of the Congress, we were able to induce the FAA to retain the ASRS. We strongly believe that a functioning ASRS or similar program is essential to provide the information we in aviation will need to improve our safety record.

ASRS has already proven to be very useful in providing information on a major problem area in human factors: management and decision-making in the cockpit.

A basic problem in cockpit management is communications—both among the members of the crew and between the crew and the air traffic controllers. ASRS reports indicate that communications errors lead to near-accidents every day. Two brief examples will indicate the nature and scope of the problem.

In one instance, neither the captain nor the first officer checked or asked the other if the aircraft had been refueled. It had not, and they took off with insufficient fuel to reach their destination. In another incident, the cockpit crew through the controller told them to fly a course of 180 degrees—which was close to the course they were expecting—rather than the course of 80 degrees he did give them.

The problems involved in cockpit management were well covered in the Resource Management Workshop that NASA sponsored in the summer of 1979. Some airlines are already beginning to implement their own programs of cockpit management in order to make the best use of all the resources available. However, ALPA believes more emphasis and research are needed to develop the best methods of cockpit management in current and future airliners.

We also see the need for more human factors research on decision-making by pilots. Decision-making often becomes critical during approach and landing when the pilot may have only a second or two to make several complex decisions that will determine if he continues the approach and lands or if he will execute a missed approach and go around.

If the pilot makes a wrong decision in this very restricted and stressful time period, he runs the risk of crashing. If that happens the NTSB will spend months analyzing what happened in those few seconds. Research in decision-making involves such items as visual cues in rain or fog at night and the information to be presented and symbology used in head-up display. More research on pilot decision-making is particularly needed in view of the current trend to lower landing minima at many airports and the growing use of approaches under Category 3 A conditions, which give the pilot very little time to decide whether to land or go around.

Another major problem area in human factors that is long overdue for additional research is crew workload. Our view is that surprisingly little work has been done at the FAA in this area, which is an obvious and essential element in human factors.

As you, Mr. Chairman, and the Subcommittee are aware, a very controversial issue in the airline industry and with ALPA is crew complement, or whether two or three crewmembers are needed in the cockpit to assure the highest level of safety.

Clearly, workload is one of the key elements needed to make a rational determination on crew complement.

We are dismayed both at the FAA's conclusion over two years ago in its crew workload study that few advances had been made in studying flight crew workload and at the agency's failure to undertake further research. At a scientific symposium sponsored by ALPA in July of 1978, many recent advances in workload study were demonstrated. We believe the FAA should have applied this knowledge in its aircraft certification process to make a complete and realistic assessment of cockpit workload.

Considering the importance of the crew complement issue, one would think much more research would have been done on the question. Unfortunately, that is not the case. There has never been an independent and comprehensive evaluation of the crew complement question, including all aspects of flight crew workload.

We urge the Subcommittee to consider authorizing such an independent study to settle the issue of crew complement. There is a wealth of expertise at NASA and in the military services that could be applied to such a study. We also believe it is especially important that such a study of workload and crew complement be carried out under conditions that accurately reflect the day-to-day airline flying. There is a vast difference in pilot condition and workload between making the first landing of the day in clear weather and making the tenth landing of the day in darkness and bad weather.

Another area that involves many aspects of human factors research is the growing use of simulators in flight crew training and checking. ALPA agrees that state-of-the-art simulators offer both better training and significant cost savings compared with actual aircraft.

We also support the concept of "total simulation" as described in the FAA's three-phase program that was implemented last July. However, there is no Phase III simulator in existence today, and we should not close our minds to possible future changes in technology that could make the Phase III simulator even better. It is definitely within the realm of technical possibility to do much of the training required for various airman certificates in the simulator.

Before we briefly discuss three other areas in airline safety, Mr. Chairman, we would summarize our discussion of human factors by saying they are the key element in airline safety today. More extensive and intensive research in almost all aspects of human factors will be needed if we are to improve our generally enviable record of airline safety in the years ahead as our skies grow more crowded and complex to fly through.

The three other areas I would like to mention briefly are:

1. Wind Shear. After a rather slow beginning, the FAA has made a commendable effort to detect wind shear around airports. The agency has installed detecors at many airports where wind shear has been a problem. However, these detectors are not the sole answer. As an incident a year ago at Atlanta demonstrated, the wind shear detectors cannot detect shears outside the airport boundary. In that incident, an Eastern Airlines Boeing 727 narrowly avoided crashing after encountering a strong shear on final approach.

The answer, we believe, is a shear detector that can be installed in the aircraft. The FAA completed testing of such a device more than two years ago, but it has still not issued a Notice of Proposed Rule Making. We do not understand why.

2. Weather Information. The continuing problem here is getting complete and understandable information to the flight crew in time. We believe it is very important that controllers tell pilots about severe weather. Now the New York and Chicago air route traffic control centers have severe weather avoidance plans, but they do not tell the pilots about them. The result is that pilots plan to fly one route and then after takeoff, are directed to fly another. The pilots should have the final say on which route they will fly.

Preliminary indications are that incomplete weather information may have been a factor in the crash of a commuter airliner earlier this summer in Nebraska. The crew were told about thunderstorm activity in the area, but not about the severity. And the storm was severe: winds of almost 90 miles per hour and large hail.

3. Runway Grooving. We believe there is a need for a continuing program to measure the friction coefficients of airline runways. The FAA has a program in effect now, but it is due to end in a month, at the end of the fiscal year.

We have also asked the FAA to test the different methods of runway grooving and friction treatment and then urge airport operators to employ the best. Currently, the operator can use any method he chooses.

We are also grateful to this Subcommittee for including in the current airport and airway development legislation a provision that specifically requires runway grooving or friction treatment as a condition for obtaining an airport certificate.

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That completes our statement, Mr. Chairman. We thank you for this opportunity to testify, and we are ready to answer your questions.

The next witnesses that we have are Mr. C. Robert Nysmith, Acting Deputy Associate Administrator, and Dr. Alan Chambers, of the Ames Research Center, NASA Headquarters, Washington, D.C.

Gentlemen, if you would come forth at this time.

First, on behalf of the committee, we would like to thank you very much for coming here. You know that we look to NASA for a lot of very important guidance in the Congress.

And at this time, I will recognize either one or both of you for opening statements. And whichever one of you wishes to lead off, make your choice.

STATEMENTS OF C. ROBERT NYSMITH, ACTING DEPUTY ASSOCIATE ADMINISTRATOR, NASA; AND DR. ALAN CHAMBERS, AMES RESEARCH CENTER, NASA HEADQUARTERS

Mr. **Nysmith**. It is certainly our pleasure to be here to testify on this subject. I am accompanied by Dr. Alan Chambers, who is chief of the Man-Vehicle Systems Research Division at the Ames Research Center. In a few minutes Dr. Chambers will give you some testimony on some of the work that is going on in NASA.

Before doing that, I would like to say that we do consider this subject and the subject of aeronautical human factors as extremely important within NASA. One of the things that we do is give special attention to the development of our relationships with the industry and with the FAA. As you can recognize, our role is one of trying to provide technical and scientific objectivity and expertise to the community. We spend a lot of time communicating with the industry and with FAA.

We do believe that we have developed, over the years, a relationship and rapport that has led to our program as being quite valuable and very productive. The NASA activities in human factors research is carried out in two of our research centers, Langley, in Hampton, Va., and Ames, at Moffett Field, Calif. The work at Langley tends to be more engineering oriented, whereas the work at Ames is really focused on flight management research. I believe that that topic is particularly relevant to your hearings here today.

Given that, I would like to turn the floor over to Dr. Chambers, who will now give you some information on the work that is going on at Ames.

Dr. **Chambers**. I am pleased to have this opportunity to make a statement regarding human factors and aviation safety. NASA has an important responsibility to provide accurate and useful knowledge to promote the enhancement of aviation technology and to assist in the achievement of the safest air transportation system. To that end, we have been and are conducting human factors research.We perceive our role to be one of providing objective, unbiased information to the Federal Aviation Administration, the Department of Defense, and other members of the aviation community. My testimony will touch only on those issues and problems which have been examined in our research program. To go further would require speculation that would not satisfy the requirements for objectivity and neutrality.

Our work in the area of human factors, as well as the work of others, has brought into focus three major areas of concern: One, the information transfer; two, flight deck resource management; and, three, the role of automation in the cockpit. By information transfer, I mean the passing of timely, accurate, and useful information to those who are in need of it, in a manner that is comprehensible. Resource management is the process by which the flight crew, and especially the captain, manage their activities and their information to accomplish their flight objectives. Many of the reports of incidents contained in the NASA aviation safety reporting system (ASRS) data base and many accidents investigated by the National Transportation Safety Board (NTSB) can be traced to inadequacies in these two areas. Although automation is not yet a major problem, we have reason to believe that in the future the allocation of roles and functions between the aircrew and automated systems may also become a prevalent element in these reports.

Let me first focus your attention on the problem of information transfer. During the period from May 1978 to July 1980, ASRS received more than 12,000 incident reports. An information transfer problem was a factor in almost three-quarters of these reports. A closer look at the reports shows that in approximately 37 percent of the incidents a message was not initiated; in another 37 percent, the message was inaccurate, incomplete, ambiguous, or garbled; in 13 percent of the incidents, the information was accurate but untimely; and, in 11 percent, it was misunderstood. Only a small number of reports, 3 percent, involved equipment failures.

Humans receive information in only a few ways—primarily by sight or sound. Eighty-five percent of the information transfer problems I have described involve verbal communications. Visual presentation of this information through data link, using discrete address beacon systems (DABS) may be a significant step toward elimination of many of these problems. But simply transferring this information from an aural to a visual mode will not, of itself, insure that the aircrew will be able to utilize it effectively. The display of additional visual information at a time when visual workload is already high, as it is during descent and approach in high-density terminal areas, may, in fact, degrade performance. In about 20 percent of the ASRS reports describing problems with information transfer—by either the aural or visual medium—the problem was a failure by the human to receive the information. Information not received cannot be used in subsequent decisionmaking.

Decisionmaking is at the heart of the second problem we have identified: flight deck resource management. We see evidence that in many instances there is a lack of effective management of information and resources that are presently available in the cockpit. In our analysis of jet transport accidents reported in the period 1968–76, resource management problems in the cockpit played a significant role in more than 60 of these accidents. The most frequently observed problems were preoccupation with minor mechanical problems; inadequate leadership; failure to delegate tasks and assign responsibilities; failure to set priorities; inadequate monitoring; failure to utilize available data; and failure to communicate intent and plans.

In all cases, these accidents shared a common factor—inability of the flight deck crew members to identify and utilize or manage the resources that were available to them. To date, our activities have been focused on improving flight deck leadership and achieving more effective crew coordination and communication. Last year, a NASA/industry workshop was held to provide a forum for exchange of ideas regarding crew training. The participants at the workshop concluded that:

Resource management is the concern and responsibility of all crew members, not just the captain, and training should be given at all stages of an airman's career;

The judicious use of techniques like role playing, group discussion, situation analysis, and interpersonal skills training can result in more effective behavior on the part of crew members; and

The use of full-mission simulation, line oriented flight training (LOFT) is a particularly important technique because it forces people to deal with dynamic, real-world, real-time situations as they encounter them in effective line operations.

Several airlines have already altered or are planning to alter their training programs as a result of the workshop. Although this is primarily a training problem, it may also require development of operational rules or guidelines that, if applied properly, would assist the crew in exercising good resource management. Further research will be required to develop these guidelines.

Information transfer and cockpit resource management are inextricably interwoven. As new technology is introduced for one, the other must be examined carefully. This brings me to the third and final problem.

Automation is frequently mentioned as a solution to human error. Modern microprocessor and display technology make feasible the automation of many flight deck functions previously performed manually. There are real benefits to be derived from automation, the question today is not whether a function can be automated, but whether it should be. If all possible flight contingencies could be identified and fully described, a fully automated cockpit could be designed and human factors would be of no concern. Clearly this is not possible today, nor, I suspect, for several decades. A crew will be present, and will be expected, at least, to function as a flight monitor and ultimate decisionmaker.

In air transport aircraft, inappropriate automation may lead to problems such as complacency, low alertness of the crew, and erosion of crew skills, thus resulting in degraded, rather than enhanced total system safety. Unfortunately, some of these problems are already with us. We are aware of the situations where loss of manual flying skills was evidenced when copilots on widebody jets, which had sophisticated autopilot-autothrottle systems, had significant difficulty in training to become captains on narrowbody jets, which did not have such sophisticated automatic systems. As the degree of automation increases, these problems may become more pronounced. Automation promises significant benefits and it is totally unrealistic to call for a halt to implementation of new technology; however, we believe that better guidelines for the allocation of functions between automatic devices and human operators are necessary.

In summary, I believe the three areas mentioned—information transfer, resource management, and implementation of automation—are of paramount importance relative to human factors and aviation safety. Further, I believe the greatest gains, both near and long term, will come through implementing improved knowledge and technology in these areas.

Senator Exon. Dr. Chambers, in the statement you just made, you indicate: "In our analysis of jet transport accidents reported in the period 1968–76, resource management problems in the cockpit played a significant role in more than 60."

Is that 60 percent? I didn't quite understand what the figures are. How many accidents did you analyze?

Mr. Chambers. Sixty is an absolute number. It is a subset of the total set of U.S. and foreign jet transport accidents that occurred during that period. I am sorry, I do not have that number to give you at this time.

Senator Exon. For the record, could you give that for us? I think it is rather significant.

Dr. Chambers. I certainly will.

[The following information was subsequently received for the record:]

Forty-four of the accidents were identified from a set of 145 U.S. Air Carrier Jet Transport accidents occurring during the 1968–1976 period. An additional 18 foreign carrier accidents were identified as a result of discussions with members of the foreign aviation community. The total number of accidents from which these 18 were selected is unknown. The intent was not to identify a specific accident cause frequency or percent, but rather to select a set of accidents that would identify the characteristics of the resource management problem. The specific accidents which were identified are listed in Dr. John Lauber's paper published in the Proceedings of the NASA/Industry Workshop on Resource Management on the Flight Deck (NASA Conference Publication 2120, March 1980.)

Senator Exon. I will yield to Senator Kassebaum.

Senator Kassebaum. Thank you, Mr. Chairman.

I thought you brought up some interesting testimony; one, because I tend to share the belief that, with all of our intricate technology, we still might miss some of the essentials insofar as human factors are concerned, how we can best deal with it.

You said in your testimony that there has been a significant step forward toward elimination of the problems, but simply transferring the information will not do it in and of itself. What will? What do you think would be the top priority?

Dr. Chambers. I was referring there to the importance of carefully investigating the different types of technology that we are introducing into the system to see what the real benefits and real costs will be. It is very easy to do a systems analysis excluding the human and to come to the conclusion that a certain display or a certain type of data link or a certain type of hard copy presentation should be the end result. That conclusion, when one puts the human in the system, may not be the same. For example, we may decide that, if, we data link up weather information, that the information should be put out in a hard copy for the crew. Depending on the circumstances, however, there may be a much more advantageous format for that. In our research, we would like to learn not only how and when to present information in a manner that would allow the crew to remember it the longest; but also, how and when to present that information in a manner that would allow the crew to forget it very rapidly.

I would like to propose that when we add or introduce something like a DABS data link, that we thoroughly understand the implications of putting that system in the cockpit before we go out and do it. I am certainly not picking on DABS data link. I think that has tremendous benefit. That is just an example.

Senator **Kassebaum**. Administrator Bond has proposed that there be a reassessment of an aircraft certification every 8 to 10 years, to update safety requirements. Do you feel that this new authority is needed?

Dr. **Chambers**. You are asking me to go beyond anything in which we have done any research. Let me only try to respond at that from a side point. Everything we have seen in our studies through the ASRS suggests that the aviation system is dynamic and is certainly not static. An aircraft certified at one point in time may be viewed differently at some point 10 or 20 years downstream. If the system were static, we wouldn't have to worry about that.

Senator **Kassebaum**. Is that too long a period of time? Should it be done in a briefer period?

Dr. **Chambers**. I really don't have any way to answer that.

Senator **Kassebaum**. In talking about increased technology and increased automation, it has been indicated that one of the problems we face is keeping the workload sufficient for the pilot's attention to be constantly alert. Would you care to comment as to how you think this weighs in consideration of two or three pilots in the cockpit?

Dr. **Chambers**. Certainly it is a factor. One of the things we have to be very careful about is the time at which the workload is the greatest in the total flight. It is conceivable that some of the things that are being implemented are things that would eliminate work during the easiest portion of the flight, when the workload is already low and when you would like to have the crew continually involved in the aircraft, in contrast to trying to help reduce the workload through automation during the very high workload periods of the flight.

I think what we really do have to make sure is that we keep the crew involved when the workload is low and we assist them when the workload is high, through the use of advanced technology and automation.

Senator **Kassebaum**. So you are saying, you feel there are times that a three-man crew is important?

Dr. **Chambers**. I didn't really answer the question, I guess. I'm not sure. We have been asked about the two versus three issue. We have not done any research directly pertaining to two versus three. It is conceivable that research of that type can be done, but I don't believe that any such research has been proposed as of this moment. It is conceivable that some has already been done by the FAA or McDonnell Douglas, but I'm not really familiar enough with that particular area to be able to comment. I think we have to be very careful to remember that certification today may, as the system changes and as the system is dynamic, be different 10 years from now.

Senator **Kassebaum**. Thank you, Mr. Chairman.

Senator **Exon**. Thank you, Senator Kassebaum.

I will direct my question to either one or both of you. First, I would like to know what NASA—this is not an area that you have testified on—what has NASA done with regard to the black box? This is something we have heard about for many years, that theoretically could be installed on all aircraft to give a warning to the pilot of another aircraft in his immediate area. I think there are three or four companies that have been working on this.

Have you done any work on this black box concept, or call it what you will?

Dr. **Chambers**. A collision avoidance system?

Senator **Exon**. Yes.

Dr. **Chambers**. We are doing some work in that area at the present time. Our concern is that when the pilot or the copilot gets information in the cockpit, indicating that he should take some action, that he believes that information and that he will act on it; and that the information will be presented to him in a way that he understands it and in a way that he is willing to accept it. We are in fact very worried that in particular cases information could be presented to a crew that suggests they take an action of one type when their intuition might suggest a different action, and that the conflict between the two might result in no action for a sufficiently long period of time that we would end up with a tragedy; or that it could just result in confusion.

We would also like to make sure, through the proper use of human factors technology, that information, which is presented, is presented appropriately.

Senator **Exon**. Do you believe that simulator testing of future workloads on two or three-man crews can be conducted in a way to provide us with a reliable answer to the ongoing controversy over crews and number thereof?

Dr. **Chambers**. We certainly have been the advocates of full mission simulation. I think from the standpoint of introducing new technology, we, at Ames, have probably done as much work in full simulation with new technology as any group. To answer your question, I am very hopeful that full mission simulation technology can play that type of a role. Our concern is that we still don't understand the methodology of that type of testing as well as we would like to. If we can get to the point where we understand the methodology and we do have a useful tool, I suspect the answer will be yes.

Senator **Exon**. Does your work indicate any concern about the procedural standardization in the cockpit? It is my understanding that some airlines leave these decisions primarily up to the captain of the individual aircraft, while other airlines have some rather stringent procedures in this regard.

I suspect that in NASA you have very stringent procedures in the cockpit and can do most of the control work from the ground at Houston. But do you have any—do either one of you have any feelings on that, on the thrust of my question?

Dr. **Chambers**. I am not sure what the thrust is. I think that most airlines have very strict procedures. When, however, one starts to investigate every specific flight, you find crews that operate differently. Some crews will give verbal communications; other crews at times give hand signals. But, I think, by and large, the procedures are followed very carefully.

Senator EXON. So from your knowledge, you don't have any criticism or suggested changes in standardization of procedures in cockpits between the airlines?

Dr. CHAMBERS. No, certainly not.

Senator EXON. I have no further questions. Gentlemen, thank you very much for coming. Is there anything that you would like to add? [No response.]

Senator EXON. We appreciate your expert testimony.

Mr. NYSMITH. Thank you.

Senator EXON. You are excused.

We apologize to the next witness for being slow in getting to him: C. Ronald Lowry, vice president, research and technology, Aerospace Industries Association of America.

STATEMENT OF C. RONALD LOWRY, VICE PRESIDENT—RESEARCH AND TECHNOLOGY, AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.; ACCOMPANIED BY DOUGLAS R. CLIFFORD, CHIEF ENGINEER, AIRWORTHINESS, SAFETY, AND PRODUCTION, THE BOEING CO.; AND GEORGE JANSEN, DIRECTOR, FLIGHT OPERATIONS, DOUGLAS AIRCRAFT CO.

Mr. LOWRY. Thank you, Mr. Chairman and members of the subcommittee. I am Ron Lowry, vice president, research and technology, of the Aerospace Industries Association of America.

As you requested, Mr. Chairman, with me today are Mr. Douglas Clifford, chief engineer for airworthiness, safety, and product assurance of The Boeing Co., on my right and George Jansen, director of flight operations of Douglas Aircraft Co., on my left. Both gentlemen will help in answering your questions at the close of my remarks.

It is a pleasure to appear before this subcommittee to testify on the subject of aircraft safety and accident prevention. Our members have long been dedicated to the further improvement of the fine safety record achieved in air transportation.

The statistical record of the air transportation industry indicates that the vast majority of all accidents has an element of human failure, either as the principal cause or as a contributory factor. Thus, a large percentage of our efforts as manufacturers is directed at making the system, including the aircraft and the cockpit, more tolerant of human error.

In this regard, there are a number of important safety items which industry and Government have, in essence, fully developed, but which for one reason or another, have not been fully implemented. We would urge that the industry and the Government regulatory agencies charged with the responsibility for their implementation move forward on these items as rapidly as possible. I will describe these first and then will have a few words to say on human factors as related to accident prevention.

First is landing aids. About half of all significant accidents occur during approach and landing. A large proportion of these accidents happen under visual flight rules (VFR) in marginal visibility conditions. The accumulated experience of many years shows that significant improvements in safety could be realized by providing guidance for all landings both for instrument and VFR. At the smallest airports and at the non-ILS runways at other airports, the guidance could be provided simply by the Visual Approach Slope Indicator, called VASI. At many airports, complete instrument landing systems or preferably microwave landing systems (MLS) should be installed, at least for all runways used for air carrier operations. The rapid deployment of MLS at all air carrier runways would be a great step forward in accident prevention.

Next is air traffic control. Midair collisions are a major concern to all of us and an alarming number of near misses continue to be reported. Safety could be significantly improved by upgrading separation assurance procedures in the following ways:

One, the existing radar beacon system should be upgraded in an evolutionary manner to the discrete address beacon system known as DABS to assure that ground radars have capability to track all aircraft under their control.

Two, as DABS is implemented, new operational procedures should be introduced to take advantage of the capability to exchange digital data between ground centers and aircraft in order to achieve improvements in both the safety and efficiency of flight operations.

Three, aircraft equipment with 4-D flight management systems can deliver an airliner to an airport arrival fix to meet a precise arrival time. In combination with new ATC metering systems—such as those under demonstration at the Denver and Fort Worth centers—congestion can be reduced, aircraft separation enhanced, and ATC and flightcrew workloads lessened, all of which can improve safety significantly. It is recommended that the pace of R. & D. for these technologies be expedited to permit their early introduction into service.

Another important safety item is runway grooving. Reduced braking action on wet runways has resulted in accidents and incidents throughout the world and has been a major concern to the aviation industry for many years. Recent results from the runway friction survey being conducted by FAA at over 200 airports indicate that grooving the pavement increases surface friction. The FAA Technical Center has just completed a study of the cost benefits of the grooving design based on full-scale testing. This study has concluded that the cost of grooving could be significantly reduced by increasing the distance between the individual grooves. There are approximately 730 airports in the commercial system, with approximately 1,000 runways; less than one-half of the runways are grooved or set to be grooved.

With the completion of this research work and because of the encouraging results of the runway friction testing program, FAA should expedite the grooving of the remaining commercial runways.

FAA certification procedures. It can certainly be no secret to this subcommittee that the FAA's aircraft type certification procedures have been undergoing careful scrutiny in the past year or so. Although we feel the present certification process is sound, we welcome Congress interest in certification because we believe such attention contributes to a greater understanding of the intricacies and effectiveness of this proven process. Certification, of course, is at the very core of our business, and it is in our best interests that it be changed or improved on a timely basis as needed. Therefore, we followed with great interest the extremely thorough study conducted by the National Research Council of the National Academy of Sciences and, with one hopefully minor exception, endorse its conclusions and would urge their implementation.

Now to turn to cockpit procedures and human factors. In the summaries of the causes of many accidents, we find words like "failure to follow established procedures." Although much effort is continually expended to improve procedures, errors can and do occur in all phases of aviation where human effort is involved.

There are many checks and balances on the efforts of personnel in design, in manufacturing, in maintenance and in the cockpit. At the point where the person in the cockpit becomes part of the system and as the time for corrective action for any error or oversight becomes critical, the price of error becomes higher and the need for proper cockpit procedures becomes more intense.

We are continuing our efforts aimed at keeping the crew's attention on the job at hand, to motivate them to do the best possible job and to provide, through human engineering, the sensors, instruments, indicators, and aural and visual cues necessary to assure the crew that their actions are correct.

As manufacturers, we use human factor evaluation techniques extensively in our cockpit design work. We attempt to design the cockpit so as to minimize the likelihood of human error and the consequences of any error. When crew complement for a particular design and model of aircraft has been established, the designer makes extensive and intensive use of simulation techniques to determine whether the cockpit workload is fully compatible with the capabilities of the proposed crew complement.

These techniques make use of all elements of human engineering and employ the latest technology in the development of the cockpit and its controls in a scientifically controlled environment.

Finally, when the airplane is introduced into the fleet, we strongly support intensive flight simulator training of the flight crews. This insures that they are exposed to all of the eventualities which may be encountered in operation of the aircraft, thus establishing cockpit discipline under real time conditions so as to minimize cockpit workload, confusion, and indecision under actual operating conditions.

The Aerospace Industries Association is proud of the fact that its members have effectively employed human factor specialists for many years. In fact, we are primarily responsible, along with the military services, for nurturing and developing this field. Because human error is still the primary source of aviation accidents, renewed emphasis should be placed on increasing the effectiveness of these techniques.

For this reason, these hearings are most propitious and FAA Administrator Bond's list of proposed research yesterday is most timely. We stand ready to assist in any way we can.

My colleagues and I will now try to answer any questions you might have.

Senator EXON. Thank you for your excellent testimony. Would you like to add anything, gentlemen?

Mr. CLIFFORD. No, sir.

Senator EXON. You described the human engineering process to describe what you come up with that shows that their actions are correct, and obviously the instruments are very important. But we read about altimeters that are easily misread and fuel gauges that are purportedly 3,000 pounds off, as was the reported case in the recent accident.

While I appreciate the expertise that you put in your product—I am not zeroing in on you and your company—is there any explanation for these kinds of instrument problems, or is that just inherent in the making of anything mechanical?

Mr. LOWRY. I think that the misreading of instruments has been a longtime human problem as regards instrumentation. I am not sure that we can be comfortable that this has been solved at this point in time. It is a matter of continuing concern.

I know that many hours are used in research on the human factors element as we proceed into new types of instrumentation in cockpits. I don't know if Mr. Clifford can add to this.

Mr. CLIFFORD. I think the altimeter is an excellent example of this. There has been within the last 2 or 3 years a in-depth human factor study of altimeter displays. It has been pretty well established that the pointer style is substantially less susceptible to being misread. This is what we are planning in our new models.

It would be, I think, up to the FAA to consider whether or not older type altimeters and older models should be changed. I would suggest that there is enough evidence to consider this. This is probably a good example of similar studies on other instrumentation.

You made mention of an error in the fuel gaging. I am not sure I am familiar with the particular case and whether or not it was a mechanical failure or a misreading.

Senator EXON. I am advised it was a DC-8 in Portland in 1978. Are you familiar with that?

Mr. CLIFFORD. Is that the fuel exhaustion accident?

Senator EXON. Yes.

Mr. CLIFFORD. The NTSB report on the accident didn't mention that there was an error in reading the fuel quantity or that there was a malfunction of the gage. That is a recently alleged situation that we have no information on, except that the pilot would like to reopen the case and has made this allegation. Actually the testimony of the crew in that case said that the captain's attention was called to the shortage of fuel, but he was preoccupied with the concern about the landing gear.

Senator EXON. I was advised that the pilot in this particular case said that he read the gage that way, and of course there was no way of knowing, I don't suppose now, whether he misread the gage or if the gage was wrong. It is one of those things that we keep coming up with.

What is your evaluation at this time of a heads-up display as an enhancement of aircraft safety?

Mr. CLIFFORD. I think the situation in the community as a whole today—the FAA, the aircraft manufacturers, the manufacturers of the electronic equipment itself—is that there is no consensus as to the requirements of such a device or what it should do. There is a great deal of differing opinion on this. Opinion in the pilot community is strongly held. There is no consensus.

There is also no assurance that any set of requirements, if they could be defined, could be actually met in practice. There is again a lot of confidence that this would be a useful device, but I have never seen any technical data that treats the issue of the loss of light transmission through the combining glass, for example, under low visibility conditions. There would be a reduction in the ability to see.

There is also a necessity for such a device that the eye point be accurately and precisely located. Our studies show that this cannot actually be accomplished in practice, and we have, as a matter of fact, given up at this time further development of heads-up displays.

Senator EXON. There have been claims that the increasing sophistication of cockpits does make things easier—easier, I say, in normal flight—but that they also present the crew with more and more complex problems when breakdowns of this sophisticated equipment do occur.

How do you respond to that question?

Mr. CLIFFORD. I would make the comment that the 737 and the DC-9 probably exemplify systems automation, the automation of the control, and operation of the aircraft systems so as to make a third crew member redundant. And the safety record and the malfunction record of these airplanes do not bear out that allegation. I am not aware of any data that says that.

Mr. JANSEN. I might address, from the standpoint of flight guidance improvements, some of the things that have been done that have permitted the crew to have more time for monitoring and assessing their individual situations. In some of the DC-9's and 737's that came along 10 or 12 years ago, each pilot was required to select the mode of his flight direction as well as address a similar mode on the autopilot.

With current automation practices, those have now gone to central control, so that one sighting basically will establish the mode for the entire cockpit instrumentation.

Senator EXON. Each witness we have had yesterday and today has had a chance, I guess, to comment on the controversy between the two and three pilots on the DC-980. Has your organization taken a stand on that, or do you care to get into it?

Mr. LOWRY. The organization has not. Perhaps Mr. Jansen can comment on that.

Mr. JANSEN. I would have to say that my organization has taken a stand on that. The DC-980 has been evolved from the earlier DC-9 models. Considerable improvement has been made, as I discussed, in the flight guidance area of the airplane.

You mentioned misreading, possibly misreading fuel gages. The fuel quantity system in the DC-980 is digital. If one can read, he can get an absolute number including the gross weight of his airplane, without having to compute from a series of positions in the cockpit.

I have personally flown the DC-980 a number of times, and I find it to be easier to fly, easier for crew management, than some of the earlier models of the DC-9.

Senator Exon. Although you did not state flatly, then I take it you are satisfied that two pilots are adequate on the DC-980?

Mr. Jansen. I am satisfied that two pilots can operate that plane safely in the environment we fly it in today, worldwide.

Mr. Lowry. If I may, I think that perhaps it might be useful to the committee to hear Mr. Clifford and perhaps even more so, to have introduced into the record a recent booklet that they have put together on their most recent aircraft which covers this subject pretty well.

Senator Exon. That would be very helpful to us. We will now accept that for the record, if you would be good enough to supply it.

Mr. Clifford. I have the book in question here.

Senator Exon. If you will just hand it to us, we would be very happy to include it as part of the record.[1]

Mr. Clifford. I would like to say a few words on this subject, if I may. Boeing has made an exhaustive and comprehensive study of the crew complement issue. As a result of this study, we are offering two new models—the Boeing 757 and the 767 with the choice of crew complements so that the airlines can have it either way.

Now this study convinced us—or it proves—that two-crew airplanes enjoy a better safety record than three-crew airplanes. There is no doubt about this.

There has been considerable discussion today as to the statistical significance of such findings. And indeed, if one limits the number of airplanes considered to the few accidents typical of U.S. domestic operations only, you have too few cases to be statistically significant, and the FAA study, in our view, was correct in this regard.

If you do studies, as we have done, of a similar nature and limit them to, say, just the 737 airplane, comparing its operation with two-crew to its operation with the three-crew, your result, again, is that the two-crew case enjoys a better safety record. But the number of events is too small to be statistically significant. And that point is made, too.

There are, however, hundreds of two-crew airplanes in the world, and many airplanes operate that way. And if one looks at these, whether one looks at all of the accidents involved, only the accidents involving fatal injury or only the accidents that are ascribed to crew factor only, there is indeed a statistical data base that can be examined.

We have undertaken to develop confidence intervals on that data base which tell us that one can expect the experience of the past to continue in the future if the situation is unchanged. That is, if there are no major changes in the ATC system, the cockpit designs or the like, then the confidence intervals for 80 and 95 percent confidence with regard to the accident rates that could be anticipated do not touch, do not overlap each other.

This does not say that our position is that two-crew is safer than three. The reason we don't say that is because we cannot get enough information to make an engineering study that has a sufficient factual basis that says that three-crew cannot be as safe as two. This is why we are offering both versions.

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[1] The material referred to has been retained in the committee files.

I do believe, however, and we have stated before in papers, that a challenge exists to insure that in the future that airplanes operating with a crew of three do, indeed, achieve the same safety effort as those with two.

Senator EXON. Gentlemen, thank you very much. I am sorry that we have to bring this to a close. I have 3 minutes to get to the floor for a rollcall vote. There are additional questions that we would like to ask that we will submit to you, and if you could respond in writing, we would appreciate that very much. Thank you for your excellent testimony this morning.

Mr. LOWRY. Thank you, sir.

[The following information was subsequesntly received for the record:]

QUESTIONS OF THE COMMITTEE AND THE ANSWERS THERETO

Question 1. You described your intensive efforts aimed at keeping the crew's attention on the job at hand, to motivate them and provide all the aural and visual cues the crew requires to ensure that their actions are correct. Yet, NASA has testified that their analysis of accident reports reveals a significant incidence of human factor breakdowns. Recognizing your efforts, are we doing enough on the human perception side as opposed to the advances in technology?

Answer. The aerospace industry has been at the forefront of applications of human factors knowledge. Modern cockpits provide an efficient and comfortable environment for the crew. Developments in instrumentation and control have been accomplished within a framework of ever increasing crew effectiveness.

While significant improvements in recognition, understanding and implementation of human factors have taken place in recent years, much more needs to be done in fundamental studies of human perception, behavior, and performance. As a first step we need to characterize the spectrum of human responses for the pilot community to ensure that our designs have the widest possible applicability. Beyond that, the systems level impact of human factors needs to be applied across all segments of the industry, FAA standards, ATC, cockpit, cabin crew, maintenance and flight operational procedures. Automation has been introduced into the airplane-ground environment to minimize distractions during abnormal or emergency conditions and to enable the crew to devote their full attention to the space-positioning of the airplane. Simplification of airplane subsystems operation has been incorporated to minimize the required attention span and reduce the opportunity for errors. One side effect of these changes has been a significant reduction in the required crew actions during normal flight operations. This has increased the potential for boredom, complacency, and the development of crew initiated distractions.

We need to understand the bases for human behavior well enough to improve predictions about operator performance before equipment is finalized. A basic understanding of how human beings think and why they react as they do in specific ways would permit optimization of the crew role definitions and ensure that automation would be applied where it is most appropriate. Such understanding would be of additional benefit in the areas of selection and training of personnel.

"Human factors" is an emerging discipline. It is based largely on empirical data describing how individual or groups of test subjects behave, perform, or react. While aviation leads most industries in the application of human factors knowledge, even more results can be expected to follow from a better understanding of the basis for human behavior.

Question 2. Would you agree to a simulator testing of cockpit workloads to resolve the crew complement issued, if such a test were conducted apart from the certification of an individual aircraft?

Answer. The crew complement issue is not amenable to a final determination independent of a specific cockpit design. A cockpit designed for operation by three crew members will not be suitable for routine operation by two crew members, and vice-versa. Analyses, simulations and flight test are used to refine the design so that it will be safe and efficient for the planned crew size. The ultimate proof of the adequacy of the design for the planned crew size lies in flight test. Only there can the stresses and motivations be sufficiently realistic to ensure a meaningful test.

Once the issue of the basic safety and adequacy of the design and procedures has been established, differences in detailed operation of different airplanes are properly the province of the market-place and the needs of the individual customer.

The hypothesized advantages and disadvantages of the third crew member are of the types which do not manifest themselves continuously; rather, they occur infrequently and under circumstances which are not specifically predictable. Simulation is not a particularly useful tool to explore such conditions. The fidelity, precision and time required for such simulations, if indeed possible at all, would be excessive for the result to be obtained.

Until we know why human beings act as they do, it remains for flight test to demonstrate on each new aircraft that the design and human behavior are compatible.

Question 3. One of the problems that will be highlighted in the NASA testimony is that of inadequate monitoring of cockpit information by crews. Have you addressed this problem in your human factors efforts?

Answer. Yes. Efforts have been continuing for many years and improvements have been made in almost every succeeding generation of aircraft reflecting an increased understanding of the problem, increased complexity of aircraft and improved technology. A brief résumé is as follows:

Warning lights distributed throughout cockpit, piston engine aircraft; addition of aural warning displays, early jets; central master caution, warning lights plus centralized annunciator panel, second generation jets; speech warning systems, DC-9-80; CRT warning systems, next generation jets; multimode electronic warning systems with priority logic, R. & D. currently underway; automatic checklists.

Specific warnings have also been added, such as ground proximity warning and altitude alerts which were oriented at solving specific operational errors which had been shown to be hazardous. So our concepts of warnings have expanded from malfunction alerts to monitoring performance at least in a limited way.

This is an important area; one in which there are many theories and few hard facts which relate to the cause of inadequate monitoring. While we move ahead toward better understanding and use of cockpit information on the part of the crew, it is essential that new features demonstrate real improvement, not just another approach. The new CRT displays which will appear on the next generation of transport aircraft make a significant improvement in the quality and interpretability of primary navigation and guidance information. Programs such as SST and the NASA Terminal Configured Vehicle Program provided the developmental experience essential prior to use of these concepts in commercial aviation.

Question 4. You stated that with human error being the primary source of aviation accidents, renewed emphasis should be placed on increasing the effectiveness of human factors efforts. In offering guidance to this Committee, what would you recommend as part of the renewed emphasis you advocate?

Answer. Understanding what caused a human factors problem does not necessarily indicate how it can be remedied. There are numerous examples of the cure being worse than the problem, when inadequate understanding of the basis for human error is coupled with a strong desire to correct a problem in a hurry.

Effectiveness of human factor efforts depends on several considerations. A thorough understanding of the nature of human factors problems and a basic understanding of human thought and action processes are of fundamental importance. Collection and dissemination of accident, incident and operational performance data characterizing the full range of crew behavior is a primary source of problem identification. Current governmental activity in this area can be strengthened by the addition of CVR and FDR data under non-accident conditions. Additional data concerning crew state and actions preceding an accident or incident might prove useful.

Fundamental research in human thought processes and the basis for human behavior, singly and in groups, is needed. This type of research is difficult, expensive and long term. It has wide applicability and should be pursued on many fronts. Government sponsorship for additional work in this area is highly desirable.

Along with sponsorship of such research we would ask that the government avoid the temptation to solve human factors problems through quick fixes which have not been tested under conditions as close as possible to real use. It is particularly important that "common sense" solutions be subjected to objective scrutiny before being legislated.

The application of new human factors knowledge to existing designs presents a unique dilemma. A particular device or installation which has been developed and tested in one cockpit environment may have serious side effects when applied to another cockpit design. These effects must be identified and understood before a rational decision to accept or reject the item can be made. In the near term, any

significant improvement in human error reduction in the cockpit will arise only from changes in crew procedures, discipline and flight operations. There are presently several thousand airliners which will be flying for many years. For early results, emphasis should be placed on the evaluation and the definition of methods of improving operations with this existing fleet.

[Whereupon, at 12:28 p.m., the hearing was adjourned.]

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AVIATION SAFETY

WEDNESDAY, AUGUST 27, 1980

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met at 9:35 a.m. in room 235, Russell Senate Office Building, Hon. Howard W. Cannon (chairman of the committee) presiding.

The CHAIRMAN. The committee will come to order.

Today we will resume our safety oversight hearings. Our first witness, Hon. James King, Chairman, National Transportation Board.

All right, sir.

STATEMENT OF HON. JAMES B. KING, CHAIRMAN, NATIONAL TRANSPORTATION SAFETY BOARD; ACCOMPANIED BY WILLIAM G. LAYNOR, DEPUTY DIRECTOR FOR OPERATIONS, BUREAU OF TECHNOLOGY; GERRIT J. WALHOUT, CHIEF, HUMAN FACTORS DIVISION, BUREAU OF TECHNOLOGY; AND EDWARD C. MONTGOMERY, SENIOR AIR SAFETY INVESTIGATOR, AVIATION ACCIDENT DIVISION, BUREAU OF ACCIDENT INVESTIGATION

Mr. KING. Mr. Chairman, I am pleased to be here this morning to present testimony on behalf of the National Transportation Safety Board on the topic of air carrier accident prevention, and specifically on the Board's accident investigation experience which relates to the role played by human factors in air carrier accidents. Accompanying me here this morning from the Safety Board's staff are William G. Laynor, Deputy Director for Operations, Bureau of Technology; Gerrit J. Walhout, chief, Human Factors Division, Bureau of Technology; and Edward C. Montgomery, senior air safety investigator, Aviation Accident Division, Bureau of Accident Investigation.

Before I begin my testimony on the shortcomings of our air safety system, I must say that overall we have the best and safest aviation system in the world. Statistically the numbers remain impressive. In 1979, for example, the Nation's scheduled airlines alone operated 12,000 flights a day in the air traffic control system. In human terms this means air carrier pilots last year safely transported 318 million passengers for a total of 256 billion passenger-miles.

Air traffic controllers, representing almost half of the Federal Aviation Administration's staff of over 57,000, operate the 500 airport control towers and 25 air route traffic control centers across the Nation. The way they do their job is reflected in aviation accident statistics, which show that the U.S. passenger fatality rate for the last 5 years has averaged well below the collective passenger fatality rate for the world aviation community represented by the International Civil Aviation Organization, ICAO.

It is also significantly lower than most other forms of transportation. However, we are concerned, as you are, Mr. Chairman, with how to make a good system better.

Looking at our accident data over the last 10 years, we can note a significant decline in the number of air carrier accidents and fatal accidents. During the period from 1970 through 1974, there was a total of 243 air carrier accidents and 42 fatal accidents. Looking at the more recent figures for the last 5 years, 1975 through 1979, the total number of air carrier accidents has dropped to 156, while fatal accidents fell to 24.

As compared to 10 years ago, we are seeing nearly double the number of passengers being carried by our U.S.-certificated air carriers. Although our aircraft are larger and are carrying more passengers, the total number of fatalities has remained essentially constant when you contrast the period 1970 to 1974 with the last 5 years. The fatality rate per million passenger-miles flown for these two periods, however, shows a drop of nearly one-half.

While these figures are encouraging, the Safety Board shares your concern, Mr. Chairman, and that of the members of the subcommittee, on the need to improve the accident record for air carriers. In particular, we agree on the need to provide additional focus on the human factors elements in accident causation.

We have prepared a chart which reflects a causal breakdown of U.S. air carrier accidents over the last 5 years. Our chart shows accidents in which we identified pilot or copilot as a causal factor. These accidents represented approximately 66.67 percent of the fatal U.S. air carrier accidents, and involved fatal injuries to 476 persons.

While our testimony today addresses primarily flight crew performance, it should be noted that our statistics show that other personnel, such as air traffic controllers, ground maintenance personnel, and other airline or airport employees, have also been cited as factors in 13 accidents over the last 5 years.

Looking to accidents over the last 5 years which have involved flightcrew issues, we have found that a majority of instances involve either the failure to follow approved procedures or directives, or improper instrument flight rule operations.

I would like to take this opportunity to review briefly several accidents which involved human error to illustrate some of the problems which we have seen over the years.

On June 7, 1971, an Allegheny prop jet aircraft was making an approach to the New Haven, Conn., Airport when it struck three beach cottages on the Connecticut shore of Long Island Sound. The weather at the time presented limited visibility because of fog. The Board determined that the probable cause was the captain's intentional descent below prescribed minimum descent altitude under adverse weather conditions without adequate forward visibility.

The captain disregarded advisories from his first officer that minimum descent altitude had been reached. The Board could not conclusively determine what motivated the captain to disregard prescribed operating procedures, but we learned two lessons from this accident. First, the importance of command authority and flight crew assertiveness—that is the nature of the relationship between the captain and crew—and the second is the need to motivate the crew to choose safety over operating commitments.

On December 29, 1972, an Eastern L-1011 crashed into the Everglades 18 miles west of the Miami Airport. The crew executed a missed approach at night, after observing an unsafe landing gear indication. They climbed out and entered a holding pattern at 2,000 feet. The light bulbs in the nose gear position indicating display were burned out, and the flight crew became distracted in attempting to reconcile the apparent landing gear problem; and they failed to monitor instruments as the aircraft slowly descended to impact.

Again, there were other factors involved. But the accident illustrates to us the importance of cockpit management and how a simple but nonroutine occurrence can distract the crew and lead to an accident.

On July 31, 1973, a Delta DC-9 aircraft was making an instrument approach to Logan International Airport in weather characterized by low ceiling and low visibility, when it hit the seawall approximately 3,000 feet short of the runway. The Safety Board determined that the flight crew failed to monitor altitude and recognize descent through the approach decision height.

The Board found that the flight was brought on to the final approach course by air traffic control closer than normal to the runway, and as a result the flightcrew was confronted with less time than normal to accomplish the landing. Furthermore, the crew had been part of a then recent merger between Northeast and Delta. Because of dissimilarities between the flight director systems used by the two airlines, the Board believes that this crew may have unknowingly selected an improper flight director mode of operation, which would have presented the crew with erroneous and confusing flight guidance information on the approach.

The accident illustrated how subtle differences in cockpit designs, coupled with habit patterns and inadequate transition training, can lead to disaster.

On April 27, 1976, an American Boeing 727 aircraft was landing at Harry S. Truman Airport in St. Thomas, V.I., when, at the expected touchdown point, turbulence was encountered which caused a lateral upset of the aircraft.

After correcting the aircraft's altitude, the pilot, realizing that he now was well beyond the touchdown zone, forced the aircraft onto the runway.

However, noting the length of runway remaining, he decided to abort the landing attempt and brought the throttles up.

Sensing the aircraft acceleration would not allow the aircraft to become airborne within the remaining runway, he closed the throttles again, applied full wheelbrakes, and waited for the end of the runway. The aircraft overran the runway, came to rest in a gasoline station, and burned.

At first glance, one would assume that this accident was caused by an inadequate decisionmaking process and by the uncertainty that seemed to exist in the pilot's mind with respect to the best course of action to be taken.

Upon analysis, however, there appeared to be a series of underlying factors which caused the pilot to react as he did and which probably would have caused other pilots to react in a similar manner had they been faced with them. These factors involved the split-second decisionmaking process and the way in which the decisionmaking can be influenced when a pilot relates familiar cues and training procedures to an unfamiliar situation.

Two of the more recent examples which come to mind involved a National B-727 which crashed in Escambia Bay in Pensacola, Fla., on May 8, 1978, and a United DC-8 which crashed in Portland, Oreg., on December 28, 1978.

In the Pensacola accident the crew was making a night approach and allowed the aircraft to descend into the water, in spite of the fact that the ground proximity warning system—a system which is designed to alert the pilot to take action to avoid this type of accident—functioned properly.

Although we believe that the ground proximity warning system has probably prevented many accidents, this crew did not take action to prevent impact—again, cockpit procedures, external illusions, and other factors were involved.

The DC-8 accident in Portland, Oreg., occurred because the captain was distracted and the crew was either unable to comprehend the critical state of the fuel or unable to communicate this to the captain.

The aircraft had a problem with the right main landing gear. The flight was holding after arrival in the Portland area while the crew was troubleshooting and evaluating the landing gear problem.

The crew, although showing awareness of the actual fuel state from time to time, failed to adequately monitor the situation. The Board believes that this failure can be attributed to preoccupation with the landing gear malfunction and anticipation of a possible emergency upon landing.

As a result of our investigations, we have made a number of recommendations over the years involving human factors. Since 1968, the Board has made 131 recommendations to industry, the Federal Aviation Administration, and pilot organizations, which stressed the following:

One, the need to improve flight deck management so as to instill a sense of professionalism among all crewmembers which will foster crew discipline and crew coordination;

Two, state-of-the-art instrumentation for pilots so that decisions can be made from real-time information rather than from expectations, past experience, and subjective confidence; and

Three, the institution of more realistic training requirements so that procedures can be rehearsed and fine-tuned, unexpected accident-enabling contingencies may be practiced in any desired sequence, including full-scale emergencies.

With regard to the Safety Board's concern about the need for more realistic training, we have some observations on current training procedures. The state-of-the-art in simulator technology has advanced to the point where the cockpit of modern jet transports, their flight characteristics, and even outside environmental conditions, can be simulated with an accurate representation of the actual aircraft response. The motion and visual cues provide the flight crew with a realistic sense of the flight environment.

Such simulators are being used by many of the major carriers to conduct a level of training heretofore not possible in the actual aircraft.

For example, in the actual aircraft, there will always be a tradeoff between the benefit to be derived from the training and the risk to which the flight is exposed by practicing certain emergencies. Whereas, complex emergencies such as engine failures combined with systems malfunctions can be given at any point in a simulated flight, they certainly cannot be safely demonstrated or practiced in actual low-altitude flight.

Furthermore, many typical emergencies can be subtly introduced to the crew in the simulator, whereas demonstration in flight, if possible at all, would require noticeable activity by the check pilot and thus degrade the training benefits by removing the surprise element.

Still another significant bonus for simulation is the ability to tailor the weather conditions—that is, expose the crew to a thunderstorn, windshear, and so forth. This has, we believe, been a major factor in alerting crews to the hazards associated with windshear and will hopefully promote avoidance of such hazards.

The use of high fidelity simulators has prompted new concepts of flight crew training—that is, line-oriented flight training, LOFT. This training involves exposing an entire crew to actual situations which can occur during line operations.

Working together as a crew to solve problems and cope with emergency situations increases the individual's awareness of flight resource management and crew coordination and enhances the performance of the individual.

The Safety Board, therefore, supports the FAA plan to permit additional flight crew training in advanced flight training simulation and the proposed rule changes published in the Federal Register last November. These actions are consistent with Safety Board recommendations on this subject.

Mr. Chairman, the Safety Board has been criticized in the past for being too quick to identify an accident cause as "pilot" or "flight crew" error. To that criticism, we can only respond that we are aware that the pilot of flight crew's actions are almost always influenced by a sequence of events.

We are expanding our investigative expertise in the human factors area so that we can delve even deeper into the "why" of an accident as well as the "what" happened.

In this regard, we are currently in the process of upgrading our data system to reflect far more human factors elements. Additional accident data will be collected to identify operational factors, such as training, experience, and procedures; behavioral factors, including preaccident observations, and psychological problems; medical factors, such as physical, pathological, and physiological problems; and work space factors, including crew station design, control display, vision, et cetera.

In expanding our data system, we are working with the Federal Aviation Administration so as to avoid unnecessary duplication in data collection.

An effective human factors program is dependent on the—and I would like to stress—all active support and assistance of all elements of the aviation community—the industry, the pilots, and their pilot associations, and the Federal Aviation Administration. With this cooperation, we are confident that we can continue to move forward reducing the opportunity for human failure in air carrier aviation accidents.

Thank you, Mr. Chairman. This concludes my prepared remarks. I will be happy to answer any questions you or other members of the subcommittee may have.

[The charts follow:]

CAUSE/FACTOR TABLE—U.S. AIR CARRIERS FATAL ACCIDENTS, 1975–79

[Excludes accidents without causal assignment]

		1975	1976	1977	1978	1979	1975–79
Fatal Accidents		3	4	5	6	6	24
Pilot/copilot	Accidents	3	3	3	4	3	16
	Percentage	100	75	60	66.67	50	66.67
Personnel [1]	Accidents	2	2	4	4	1	13
	Percentage	66.67	50	80	66.67	16.67	54.17
Airframe	Accidents					2	2
	Percentage					33.33	8.33
Landing gear	Accidents			1	2		3
	Percentage			2.0	33.33		12.5
Powerplant	Accidents		1	2			3
	Percentage		25	40			12.5
Systems	Accidents			1			1
	Percentage			20			4.17
Instruments/equipment and accessories	Accidents						
	Percentage						
Rotorcraft	Accidents					1	1
	Percentage					16.67	4.17
Airport/airways/facilities	Accidents	1	1		1		3
	Percentage	33.33	25		16.67		12.5
Weather	Accidents	2	4	2	1	3	12
	Percentage	66.67	100	40	16.67	50	50
Terrain	Accidents	1					1
	Percentage	33.33					4.17
Miscellaneous	Accidents						
	Percentage						
Undetermined	Accidents						
	Percentage						

[1] Such as ground crew, maintenance personnel, weather personnel, traffic control personnel.

Source: National Transportation Safety Board.

CAUSE/FACTOR TABLE—U.S. AIR CARRIERS FATAL ACCIDENTS, 1975–79

[Involves 24 fatal accidents]

Detailed cause/factor	Cause	Factor	Total
Pilot			
Pilot in command:			
Attempted operation with known deficiencies in equipment	1		1
Continued VFR flight into adverse weather conditions	1		1
Diverted attention from operation of aircraft	1		1
Failed to follow approved procedures, directives, etc	6		6
Improper IFR operation	4		4

CAUSE/FACTOR TABLE—U.S. AIR CARRIERS FATAL ACCIDENTS, 1975–79—Continued

[Involves 24 fatal accidents]

Detailed cause/factor	Cause	Factor	Total
Improper in-flight decisions or planning		4	4
Inadequate preflight preparation and/or planning	2		2
Mismanagement of fuel	1		1
Exercised poor judgment	1		1
Misjudged distance and speed	2		2
Misunderstanding of orders or instructions	1		1
Physical impairment	1		1
Subtotal	21	4	25
Copilot:			
Failed to follow approved procedures, directives, etc	1		1
Mismanagement of fuel		1	1
Subtotal	1	1	2
Personnel			
Rules, regulations, standards personnel	1		1
Maintenance, service, inspection:			
Improper maintenance (maintenance personnel)	1		1
Improperly serviced aircraft (ground crew)	1		1
Inadequate inspection of aircraft (maintenance personnel)	1		1
Inadequate maintenance and inspection	1		1
Operational supervisory personnel:			
Failure to provide adequate directives, manuals, equipment		1	1
Deficiency, company maintained equipment, service, regulations	1	1	2
Weather personnel			
Traffic control personnel:			
Cleared aircraft to wrong runway for existing conditions		1	1
Issued improper or conflicting instructions	1		1
Other	2	2	4
Airport supervisory personnel			
Airways facilities personnel			
Production—design personnel			
Miscellaneous—personnel:			
Pilot of other aircraft	1		1
Ground crewman	1		1
Third pilot			
Flight engineer:			
Inadequate preflight	1		1
Other		1	1
Flight personnel			
Dispatching (air carrier only):			
Failed to keep flight properly advised		1	1
Subtotal	12	7	19
Total	34	12	46

The CHAIRMAN. Thank you very much, Mr. King. Let me ask you, on these accidents that you pointed out, while one or two of those I realize was just caused by going below the flight minimums, and I don't know that you can adequately simulate that particular problem—if a fellow is going to go below, he's going to hit something if he's that much below it.

But on some of those, it seems to me that they could have been given training, simulation training in those areas. Let me ask you: If simulators were available at those points in time that the substantially similar flight conditions could have been simulated for them to give training on it?

Mr. KING. Additional simulator training could have represented similar, if not identical, situations to those I have outlined. For example, simulator training might aid in crew assertiveness.

That's why we are heartened by the concept of the LOFT program. In such a program, you put the crew together and simulate such situations as, for example, captain, you are flying by your watch; in 10 minutes the plane is coming down; would you like it to be on the runway or do you want it in the woods? Captain, we're coming on approach into New Haven; there are no visuals on that approach. I don't think the land is much higher than 3 feet. What are you looking for?

The question is, what kind of crew are you looking for? Should the first officer have been more assertive in that particular situation?

The CHAIRMAN. Of course, they could have been given simulator training where they went below minimums and actually crashed, and that probably would have been a good reminder to them in the real life situation, once they go through that kind of an exercise.

I have been in military simulators myself and seen a pilot not take corrective action fast enough and actually crash short of the runway. And that impresses it on his mind pretty well.

Mr. KING. I couldn't agree with you more. I was in a simulator with some folks and we crashed on approach on landing in St. Louis. And it happened to be with a professional pilot and he was a little taken aback. It was on his transition from his instruments to his visual and he lost the aircraft. It was a high-performance aircraft.

The CHAIRMAN. Now, going back to the simulators again, what has the Board found the situation with respect to the simulators? Does each carrier go out on his own and decide what simulators they're going to use and what degree of training they're going to give on those simulators?

Mr. KING. That's basically it. Each carrier has their own training program, as long as it conforms to FAA regulations..

The CHAIRMAN. I couldn't hear you.

Mr. KING. I'm sorry. Each one of the carriers has their own training program. Mr. Montgomery?

Mr. MONTGOMERY. Yes, Mr. Chairman. The decision is the carrier's own of what equipment he will buy. However, the program has to conform to the FAA regulations, and so the carrier would have to demonstrate to the FAA that his training program is comprehensive and fulfils the requirement.

The CHAIRMAN. Do the carriers have the latest state of the art simulators now on an individual basis for use? Or should I perhaps address that to Mr. Ignatius when he comes up here?

Mr. KING. I think Mr. Ignatius would be looking forward to responding to that.

The CHAIRMAN. What is the NTSB's view of the two new proposed views that Mr. Bond announced Monday, to: one, review cockpit voice recorders and flight data recorders; and, two, take nonessential tasks, such as car rental reservations, out of the cockpit?

Mr. **King**. Let me first comment, on the company radio use. We have run into situations where crew distraction occurred when a company radio was being used. So we would support this proposal.

We have some reservations concerning the proposal to spot check pilots based on periodically pulling the CVR. I think the thought itself is excellent. Information you might gain from such an exercise would provide material for the simulation we're talking about. That would be extraordinarily useful.

However, Mr. Chairman, we do have serious reservations about allowing planes to fly for 8 hours without a CVR. There is also a problem with the length of the tape. The CVR has 30 minutes of tape. It's self-erasing. So really, all of your data would basically be obtained during your landing aspect, taxi and stop at the gate unless the aircraft breakers were pulled earlier. And if the crew remained at the gate in discussion and the CVR wasn't shut down, your tape will continue to run.

You may wish to explore a longer tape. I know ICAO has talked about having a CVR tape that's longer than the standard one-half hour. Now that would give you, if you had a decent flight data recorder, that would give you some comprehensive data that you could correlate and use for your training and see what the performance of all the parties would be in that setting.

But leaving—but removing a cockpit voice recorder and permitting that plane to take off without a cockpit voice recorder really short circuits the original purpose of the recorder—accidents investigation.

I think we would do air safety enormous damage if any airplane were to leave the ground without having an operating cockpit voice recorder. That's the only place where we have a reservation, Mr. Chairman.

The **Chairman**. What about those accidents that you described? Were the cockpit voice recorders recovered in each of those instances?

Mr. **King**. Yes.

The **Chairman**. In each of those?

Mr. **King**. Yes, sir.

The **Chairman**. What about the flight data recorders?

Mr. **King**. Yes, sir. I believe in each of those cases the flight data recorders were recovered. By the way, I would like to add, on the FAA's statement in which they indicated that they would look at the grandfather clause for newly manufactured planes, we were very heartened from the point of view of flight data recorders.

The main line aircraft, as you know, is the 727. The DFOR on board the 727 presently has very few parameters. It is probably the least sophisticated recorder currently in use in the world. So we have some of the best planes equipped with very primitive flight recorders.

We would like to see these models of aircraft required to carry a state-of-the-art recorder with an expanded set of parameters.

The **Chairman**. Wouldn't a review of the CVRs enhance cockpit discipline and perhaps identify crews that might be in need of further simulation training?

Mr. **King**. Absolutely. But what I'm saying is—I think it would be an excellent training tool. What I'm saying, though, is with the

30-minute tape and possibly half of that time being on the ground, it doesn't really deal with the whole picture.

What we're saying is from a practical point of view, you are going to have to have a longer tape.

The **Chairman**. Is there any problem? There shouldn't be any design problem in connection with making a 1- or 2-hour tape, should there?

Mr. **King**. Our colleagues in the international field believe that there shouldn't be. I for one feel that there should be a longer tape. That's a personal feeling. The Board does not have a formal position on this, Mr. Chairman.

The **Chairman**. You have given a good picture of the desirability of LOFT training in advanced simulators. Should the FAA be moving more rapidly to make this kind of training a requirement for all airline crews, or are you satisfied with the carriers' decisions on training techniques?

Mr. **King**. Yes, I believe it should. I would like to see the total crew trained as a total crew, with everybody.

The **Chairman**. In October of 1978, Member McAdams wrote a memo to the Board on the need for more human factor analyses in the Board's investigations. What are your comments on that memo and the Board's current thoroughness in pilot error accidents?

Mr. **King**. The first thing is, as I mentioned in the report, we have started with our information collecting system and our storage system, which is our data. There's usually between 40 months and 48 months to get one of those things converted. We are moving.

The real question is cooperation. We get considerably more, if you will, considerably more hard information out of an accident where there is fatal injuries than we get out of living flight crew. And that's because of the present system.

We can request but I can't remember any time we have been able to get a complete medical on the crew right then and there, as well as immediate access to the flight crew. We don't ask for this in the event of a life-endangering condition, but there are times when we're out there when the advice given to the flight crew is: Don't talk. We want to sit down and talk to you for 2 or 3 days. Then you'll be available for the NTSB.

There has to be a cooperative spirit if we're going to talk about expanding parameters of human factors, especially with the flight crew. We're talking directly about doing an analysis of the flight crew, whether they're alive or dead.

One always must use judgment and discretion, because you're dealing with personal lives, too. But I think that's part of the total picture that has to be developed. We don't have that kind of material now, Senator. We are continuing to make the effort and we can report back to you, if you would like, as to the kind of cooperation we're receiving in the field of the accident sites.

The **Chairman**. I think it would be very important that you do give us a report on that.

In the course of your investigation, let's say, of a fatal accident, do you go back and examine the human factor effects on a particular pilot or the crew for several days prior to the accident, or do you limit it to the time of the accident incident?

Mr. **King**. Mr. Walhout, would you like to address that? Mr. Walhout is head of our Human Factors Division. This is the practitioner.

Mr. **Walhout**. Yes, sir. When we investigate an accident, we usually look at the pilot's background from the standpoint of what were his activities over, say, the last 3 days. We do not usually go back into his past life or lifestyle or whatever.

The **Chairman**. At least the past 2 or 3 days could impact.

Mr. **Walhout**. Very much so, especially in the sense of fatigue of the pilot.

Mr. **King**. But quite frankly, Senator, we'd like to do more in this area. As you know, we also review FAA actions, and it's interesting to note that many relate to airmen's tickets. Airmen have very substantial interpersonal problems that have profiled in their work performance—not leading to an accident; we haven't seen them in the context of an accident.

So we have identified some of the problems out there which have not come from accidents. So for example, drinking. When we're talking implied consent, I think we have two cases in 20 years where drinking has been involved with an accident in an air carrier.

The **Chairman**. What is the Board's position on the crew complement controversy?

Mr. **King**. Quite frankly, Mr. Chairman, we have listened to it like everyone else. We do not have a formal Board position on this issue. Quite frankly, the staff has looked at it from our accident history and does not feel the slim statistical base can be a valid projections for the future.

The **Chairman**. Let me ask you this. Has the Board ever found an accident to be related to the lack of a third or additional crew member?

Mr. **King**. I think I would say no. Mr. Laynor?

Mr. **Laynor**. Mr. Chairman, we really have not reviewed our accidents from the standpoint of whether the absence of a third crew member or whether the addition of a third crew member were factors in the accident per se. We feel as though—I think the staff feels, at least, that this would be a highly subjective evaluation. We haven't, to my knowledge, cited the existence of a third crew member, or his absence, as a factor of the accident.

The **Chairman**. Have you ever found in investigating an accident that the cause could have been related to too high a workload imposed on the crew members?

Mr. **Laynor**. Well, certainly, when you investigate accidents, like the Southern DC-9 in New Hope, Ga., you might question whether a third crew member could have assisted the captain and first officer in resolving the engine problems that that crew was confronted with.

The **Chairman**. Is that the one where you had the ice ingestion?

Mr. **Laynor**. Heavy water ingestion. There are lines of thought that the engine damage was such that the crew member may not have made any—the third crew member—may not have made any difference; however, we can't really say.

The CHAIRMAN. Now, in that accident, was there any question about whether the pilot could or should have avoided the cells that he went into?

Mr. KING. There was a long discussion on that. One of the questions concerned the heavy rain the pilot was in. We're not sure whether he had ever seen this. As we come back to simulation ——

The CHAIRMAN. I can't hear you.

Mr. KING. I'm sorry. There was a question as to whether that pilot or any member of the crew had ever seen the kind of weather depicted on the radar display. I don't think he had ever seen a 6, a 5 or a 6.

The other thing was that the weather itself. He was in precipitation. We don't know how that affected the attenuation on his radar, so there's a real question of how far he could see, and then what he actually saw.

So we spent a lot of time looking at that, Mr. Chairman. Everybody in that region of the country knew about this incredible line of thunderstorms coming up. It went up to over 50,000 feet. It was moving at over 55 miles an hour. It seemed that everybody in the business knew about these storms, except the controller and the flight crew.

And that's the part of the thing: the useful communication of weather to the people who are really making the decisions. And we've seen that—we saw that just recently in an accident last June involving a commuter, Air Wisconsin. It seems that everyone knew about the storm except the controller and the flight crew.

The CHAIRMAN. ALPA and Boeing directly contradict each other on the fact of whether there have been more crew-related accidents among two- or three-man crews. What are the correct statistics on it?

Mr. KING. We have a set of statistics, Mr. Chairman, that we are submitting for the record. Mr. Laynor, would you speak to that?

Mr. LAYNOR. Well, not having seen ALPA's—the accidents which they they are considering crew involvement, it's hard to respond to the question, Senator.

The CHAIRMAN. But you can respond to the question from the standpoint of: what are the statistics, as far as you're concerned, with respect to the two- versus three-man crew accidents?

Mr. LAYNOR. The statistics, based purely on accident occurrence and the number of crew members on board, indicate that the two-man crew aircraft may be in many cases safer than the three-man crew aircraft, from the standpoint of accident rates per 100,000 aircraft hours flown, or accident rates per 100,000 departures.

However, it would be——

The CHAIRMAN. Now, are those crew-related accidents, where the actions of the crew was a related factor to the accident?

Mr. LAYNOR. No, sir. Therein lies the subjectivity of such an evaluation. You would have to look at each and every accident to say whether the number of crew members was, in fact, a factor in that accident. And that we have not done.

The CHAIRMAN. Would it be possible for you to provide for our record—could you analyze your past accident reports to determine those that were crew-related, and compare those to the two- vis-a-vis the three-man crews?

Mr. LAYNOR. Yes, sir, we can provide those types of statistics. There is, again, subjectivity. It's an evaluation factor. We may, for instance, look at the DC-8 in Portland, Oreg. That was a three-man crew aircraft. It had run out of fuel. We had a DC-9 down in the Caribbean that ran out of fuel. We have low approach accidents wherein extraneous conversation in the cockpit was a factor with both three-man and two-man crew aircraft. We have midair collisions with three men in the cockpit, and we have them with two men in the cockpit.

So it's somewhat subjective if we view the accidents in the sense that if there had been a third man there, would the accident have been avoided, or why wasn't it avoided with the third man.

The CHAIRMAN. Well, could you give us just the bare statistics where the accident was a crew-related accident, indicating that it probably could have been avoided had the crew performed properly, and then compare those statistics against the two- versus three-man complement?

Mr. KING. We can do that, Mr. Chairman. There's only one caveat I would like to give, and that is: that we do not see the accident that didn't happen. We have no idea as to how many accidents might have been prevented by a third crew member. We deal with the abnormal occurrences. We can break those figures out. I'm not sure how much statistical extrapolation we can get. We can give you those raw numbers.

[The following information was subsequently received for the record:]

NATIONAL TRANSPORTATION SAFETY BOARD,
Washington, D.C., September 30, 1980.

Hon. HOWARD W. CANNON,
Chairman, Subcommittee on Aviation, Committee on Commerce, Science and Transportation, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: During your Subcommittee's recent hearings concerning aviation safety, you requested that the Safety Board review its crew-related air carrier accidents to determine the accident rates for two-person versus three-person crews.

Attached is the accident data you requested. The collection period covers the 13-year span from 1967 through 1979; the 1979 data is preliminary. The data selected are for only those accidents involving turbojet aircraft operated by U.S. Certificated Route Air Carriers where the crews have been cited as causal factors. The turbojet makes and models are grouped into two distinct categories: those aircraft utilizing two-person crews and those utilizing three-person crews. At the present time the Boeing 737 is the only aircraft which is being flown by both two-person and three-person crews, and, therefore, is shown in both categories.

The accident rates, total and fatal, were computed using both hours flown and departures as the exposure denominators. The data are tabulated to show the accident rate record of each make and model aircraft listed under these denominators. The hours flown, departures, and associated rates were then totaled to show comparisons between the categories.

Meaningful interpretation of the tabulated data is difficult in that rates will vary depending upon the aircraft used and the base of comparison—departures versus hours flown. Overall our data shows that the two-person crew has a lower accident rate when based on departures and a higher rate when based on hours flown. If one examines individual aircraft, the DC-9, two-person aircraft has a total accident rate of 0.233 per 100,000 aircraft hours flown, which equals the rate of the DC-8, a three-person aircraft. Yet, the DC-9's total rate per 100,000 departures drops to 0.192 and the DC-8's rate increases to 0.628. On the other hand, the two-person crew Boeing 737 has a lower accident rate across the board than its three-person counterpart.

Interpretation of the Board's data is also limited in that our data do not reflect either workload conditions in the cockpit or risk factors involved in the type of flight flown. Most importantly, conclusions pertaining to the overall safety of the two versus three-person crew are not statistically meaningful, given the limited data upon which our accident rates are based.

With these caveats in mind, we hope the attached chart is of use to the Subcommittee.

With kind personal regards,

Sincerely,

James B. King, *Chairman*.

Enclosure.

ACCIDENTS AND ACCIDENT RATES—SELECTED TURBOJET AIRCRAFT MAKES AND MODELS, U.S.-CERTIFICATED ROUTE AIR CARRIERS—ALL OPERATIONS 1967–79 (1979 PRELIMINARY)

[Pilot, copilot or flight engineer cited as causal factor]

Aircraft make and model	Accidents		Aircraft hours flown	Accident rates per 100,000 aircraft hours flown		Aircraft departures	Accident rates per 100,000 aircraft departures	
	Total	Fatal		Total	Fatal		Total	Fatal
2 person crew:								
DC-9	26	[1] (5) 6	10,641,027	0.244	0.047	13,546,638	0.192	0.037
BAC 1-11	2	0	1,248,295	.160	.000	1,840,000	.109	.000
B-737	1	0	975,403	.103	.000	1,169,664	.085	.000
Total	29	[1] (5) 6	12,864,725	.225	.039	16,556,302	.175	.030
3 person crew:								
B-737	5	1	2,366,495	.211	.042	3,084,718	.162	.032
B-707	22	[1] (5) 7	12,558,480	.175	.040	4,097,466	.537	.122
B-720	3	0	2,384,093	.126	.000	1,398,853	.214	.000
B-727	30	9	24,110,453	.124	.037	19,171,885	.156	.047
747	8	0	3,329,396	.240	.000	874,773	.915	.000
DC-8	18	4	7,412,290	.243	.054	2,864,417	.628	.140
DC-10	2	1	2,331,581	.086	.043	959,448	.208	.104
L-1011	3	1	1,327,410	.226	.075	612,376	.490	.163
Total	90	[1] (21) 23	55,821,008	.161	.038	33,063,936	.272	.064

[1] Midair collisions nonfatal to air carrier occupants excluded in fatal accidents rates.

Collision between different make and model aircraft counted as one accident in totals (B-727 versus B-707).

Source: National Transportation Safety Board.

The **Chairman**. You have already referred to the weather situation in a couple of instances. What do you think could be done to improve the weather information available to the pilots?

Mr. **King**. Whoever is giving the weather is going to have to give a method of effective communication to the controller, and the controller then give real weather to the flight crew. That is the critical link.

We seem to gather the data, but somehow, there is a problem with that link between the weather system that gathers the data here and effective communcation to the controller. One of the things I know that would be looked at would even be—I think FAA is looking at it now—for weather displays on the screen itself, on certain types of weather. We're talking about on thunderstorms, 4's, 5's, and 6's, where there shouldn't be aircraft in that area, so if you see anything in there, you vector them out of it.

The **Chairman**. I am reading from a rather interesting summary here:

> I tried to obtain a weather briefing from "Blank" Weather Bureau for a flight to Mankato, Minnesota. The weather was marginal with thunderstorms reported. The only information I could obtain from the briefer was last-hour reports and a written forecast for the area. When I asked for a radar report and convective outlooks, all

we were told was that there were thunderstorms over the whole area. When pressing for more information, I was told that they had weather reports to get out for the radio and television stations, and didn't have any more time to talk to me.

Now, that's a situation that certainly ought to be corrected, if that kind of condition is widespread, oughtn't it?

Mr. KING. Absolutely. But by the way, understand that the philosophy of the air traffic control system is that of separation. What we are talking about is additional information conveyed from the controller. So it's a change, if you will, in philosophy in the relationship between the controller and the flight crew.

The CHAIRMAN. Well, do you have the problem of increasing workload of the controllers? So maybe we need two more controllers in the control center to take care of the increased workload.

Mr. KING. I should like to think that certain information could be conveyed very quickly, within an appropriate time frame.

The CHAIRMAN. Now, another point that you have made here is that many of these accidents resulted in altitude or came about because of altitude deviations. Does the Board have any recommendations which might reinforce the crew objection to altitude? I am talking now about where the first officer tells the captain, "You are going below minimums." What do you do?

Mr. KING. This is where, for example, the LOFT program for training is helpful, you can bring in crew assertiveness there.

For example, the worst civil accident we've ever experienced from a fatality point of view, Tenerife, might have been prevented had the captain just pressed his button and said to the control, "Am I cleared for takeoff?" His first officer had said, "I don't think he cleared you." He might have pushed the button and said, "Am I cleared?"

The captain, though, had a very tough reputation. He was one of the highest rated captains in that particular fleet. He had a very strong personality, and he had established a reputation "you don't question me." Now, how do you train——

The CHAIRMAN. I can understand, in many instances, that if a first officer gets too assertive he may find himself being a third officer rather than a first officer. And he probably has some concern about that. I don't know how you get at that problem, you know, because the ultimate decision is that of the captain in command of the airplane. He's the man that has that responsibility.

Mr. KING. But you can develop a professional relationship where those things can be raised and raised in a professional context. Where the captain's attention is, in fact, that's what LOFT is designed to do.

You might identify a personality that won't permit the crew to really have input in a decisionmaking process. It isn't the DC-3 days where the captains could sit there and they could manage a lot of it; this is a cooperative effort, and it can't be executed by one person. As a matter of fact, I think everyone's in agreement on that, because you wouldn't be asking us about crew complement questions, because if one person could fly the aircraft, then why do we have whatever number above one?

So if we're going to have a second and third, or whatever, in that crew complement, their role should be defined. That crew assertiveness has got to be a part of it. As you suggest, though, the person who's flying the aircraft has to make the ultimate decision; we're not quarreling with that. We just want to be certain that all the facts are brought to their attention, and it's brought in a manner that's professional, timely, and permits us to be part of the equation and judgment.

The **Chairman**. A number of the past recommendations you supplied to the committee are labeled "closed, unacceptable action" as their status. What does that mean?

Mr. **King**. That means we've ceased flogging a dead horse, Mr. Chairman.

The **Chairman**. Do you just forget about those recommendations?

Mr. **King**. No, sir.

The **Chairman**. That aren't accepted after a period of time?

Mr. **King**. We have quarterly meetings with the FAA to discuss recommendations. For those closed recommendations or those with unacceptable action, we can always reissue the recommendation.

The **Chairman**. Has the Board done any work on fatigue as a factor in the pilot error type of accident?

Mr. **Walhout**. Fatigue, of course, is a very difficult subject, because it's very subjective. And people react differently to fatigue. But, to answer your question, we have written an internal briefing paper on the subject, and we could supply that for the record.

The **Chairman**. Will you supply that to the committee?

Mr. **Walhout**. Yes, sir. But we have not made any special studies.

[The following information was subsequently received for the record:]

National Transportation Safety Board,
Bureau of Technology,
Washington, D.C., November 23, 1979.

HUMAN FACTORS INVESTIGATION NOTE

Subject: Fatigue

Air safety investigators agree that many erroneous decisions and inappropriate or delayed actions responsible for aircraft accidents can be ascribed to fatigue. This fact is not only true in aviation but also in the other modes of transportation. Unfortunately, the investigator is handicapped by the lack of a test or index for the quantitative measurement of fatigue in any one individual. Although many of the physical, physiological, psychological, and environmental factors leading to fatigue are well known, the mechanisms involved in the overall complex are still poorly understood.

Fatigue means different things to different people but it remains unquantifiable when applied physiologically to refer to decrements in organic response resulting from activity. For the accident investigator, a suitable definition of fatigue is: "that detrimental alteration or decrease in skilled performance related to duration or repetitive use of that skill, aggravated by physical, physiological, and psychic stress."

From the human factor aspect of accident investigation, fatigue is usually divided into two types: (1) skill fatigue and (2) chronic fatigue. Skill fatigue is that attrition resulting from the repetition of a task during a mission or job. The symptoms are lassitude and disinclination to further activity. Flying requires prolonged detailed attention to multiple tasks and therefore is conducive in varying degrees to skill fatigue. The etiological pattern varies with the individual and with the manner in which he is affected by intrinsic factors such as boredom, responsibility, frustrations, concentration, apprehension, and anxiety; and also by the extrinsic factors associated with flying, such as hypoxia, noise, vibration, inability to move about, feeding and elimination problems and the numerous other considerations inherent in aircraft operations.

Chronic fatigue is a cumulative phenomenon which occurs when physical and mental recuperation between repeated missions is incomplete. Factors involved are

the difficulty and duration of the mission, and the duration and effectiveness of the between mission time for rehabilitation.

The term fatigue has long been, and will continue to be, a "catch all" factor, often used to resolve unexplained human error accidents. Unfortunately fatigue remains a vague term affected by innumerable factors; its effect varies from individual to individual and it can only be measured in general terms. Only with continuing effort and intense human factor investigation into both the physiological and psychological aspects of human error accidents will fatigue be understood better and be applied more intelligently as a cause factor in accidents.

Prepared by:

ANDREW F. HORNE, M.D.,
Flight Surgeon.

Approved by:
GERRIT J. WALHOUT,
Chief, Human Factors Division.

The CHAIRMAN. Has the Board ever found a failure of the controller's equipment—that is, computer, radars, et cetera—to be a contributing factor to an aircraft accident?

Mr. LAYNOR. No, sir, we have not cited the failure of an air traffic control computer to be a cause of an accident.

Mr. KING. There have been some discussions about the role of air traffic control. San Diego was one of them, Mr. Chairman, but the feeling was that the visual flight rules were in; there were certain responsibilities for the flightcrew at that time. Our question was: When you have equipment that's better than the flightcrew's eyeball, should you stay with that equipment, so you provide that kind of separation? It's our feeling you should, but that's not the call. As you know, a lot of it's been imperfect language and lack of understanding. It's a communication breakdown.

I think FAA is making considerable efforts to have standard operating procedures as far as language is concerned. That is one of the really critical items that we've run into historically. There may be trendings and other kind of things that we don't see, Mr. Chairman. I don't want to make it sound like we're the absolute judges.

Again, we deal with accidents, and the ones that we see. So that hasn't been the case.

The CHAIRMAN. Senator Kassebaum?

Senator KASSEBAUM. Does the Board have any statistics which show any relationship between delays such as holding patterns, late arrivals, and so forth, and accident occurrence?

Mr. KING. No; there was the New Haven accident, which involved contract incentive for pilots to bring the aircraft into the airport. There was, if you will, a kind of cash bonus.

Senator KASSEBAUM. If traffic is backed up over an airport, is there anything that you have statistically that would indicate this jeopardizes safety?

Mr. KING. Not right now. I think there was a Pan Am flight that almost ran out of fuel coming into Newark that had been on holding for some time. We haven't had one yet, but it is a question of, you know, can it happen? And obviously the answer to that would have to be yes.

Senator KASSEBAUM. Does the Board review incidents reported by the aviation reporting system?

Mr. KING. We review them in an informal sense, an exchange of information. But in a formal sense, no, we do not. That is, as you

know, handled by NASA and FAA does the review. But in a formal sense, no. We don't have the capacity to do it, Senator.

Senator KASSEBAUM. I'd like to go back a minute to the CVR's. Is that privileged information?

Mr. KING. You asked a good question, Senator. We have treated the data that we have gotten from the CVR with care. It is not privileged in the sense that it is not covered under "Sunshine," if you will. Generally it is, private property. It belongs to the airline itself. They relinquish possession when they bring that tape in. We have a laboratory where we read out the tapes. And when we have finished, we then reduce it to a transcript and we return the tape to the company or to the country, because we do a lot of foreign readings.

Senator KASSEBAUM. In the case of an accident it goes directly to you?

Mr. KING. Yes; we pick up the so-called black boxes which, in fact, are orange.

Senator KASSEBAUM. Is it also under the Freedom of Information Act at that point?

Mr. KING. We could be called under Freedom of Information to release that. And we could have, if you will, a scenario where Purient Records would like to make a high fidelity record of the last 3 minutes of 10 aircraft accidents. If we actually had a file of those tapes, they could be taken under Freedom of Information and played.

We do not keep the tapes. We return them, as we said, to the owners. So we don't have possession. But that is an area that could be of concern, because I am not sure how many of us in this room, or elsewhere, would like to have a continuous tape loop of what we are doing at our workplace to be available for public consumption.

Senator KASSEBAUM. Do you feel it, then, should be privileged information?

Mr. KING. My feeling is that it should be used for safety, for training and accident prevention I thought the suggestion from FAA has an enormous constructive potential. On the other hand, it has the potential to be shortcircuited by the people who operate it for fear of harassment, abuse, or use that would possibly work against what they view as their interest.

Senator KASSEBAUM. After an accident, and your interviewing the pilots or a crew, are those conversations privileged information?

Mr. KING. No; we do it with the parties and there is a transcript made of that interview, and it is part of the public docket.

Senator KASSEBAUM. Thank you.

Mr. KING. One additional thing. Information from the CVR can't be used for enforcement. There is a waiver on that that anything the pilot says can't be used against him in an enforcement action by FAA.

Senator KASSEBAUM. Thank you.

Mr. KING. You are welcome.

Mr. BARCLAY. Mr. King, just to make clear for the committee, despite the fact that we have simulators today where you can through emergency situations, realistic emergency situations such as in the Eastern Airlines Everglades case, you can put a crew on final approach and tell them they've got a light that says their landing gear is not down and locked and they've got to solve the problem. We have simulators to the state where they can realistically present that kind of situation to a crew.

Yet, isn't it true that we really haven't changed the Federal regulations on training? That we've simply taken what we used to do in airplanes, that was naturally limited for safety reasons, and put that into simulators? And that we haven't gone further, as technology has advanced, with the simulators? Are we interpreting this correctly?

Mr. KING. Mr. Laynor?

Mr. LAYNOR. Yes; you have, Mr. Barclay, I think that we have gone further in simulators. As Mr. King mentioned in his statement, simulator capability to reproduce certain situations far exceeds the ability to reproduce those situations during actual flight from both the safety consideration and the aircraft design consideration.

A simulator is basically software. Software can be twiddled, so to speak. Somebody outside the cab can be introducing failures that you couldn't possibly introduce into the aircraft.

Mr. KING. The simulation will only be as good as we permit it to be. The technology is there. You are absolutely correct.

Mr. BARCLAY. I guess I'm asking, we're now—aren't we leaving it up to each individual carrier? Obviously some of them are doing an excellent job. Is there a need for more standardization? Should the regulations be changed at all to require that all airline pilots get this kind of training?

Mr. KING. The regulations certainly could go much further, although we have not identified any failures of the system as a result of the fact they do not require more. A training program should be able to identify certain universals. There are instances where you would want the flexibility to expand a training program for a given carrier beyond these universals. For example, as we mentioned—I think the Delta with the Northeast situation, where you might have different people working with different equipment being brought together.

Mr. BARCLAY. In other words, you think our training regulations are adequate today, is I guess what I am trying to get at. They are taking advantage of the state of the art.

Mr. KING. No; they do not meet state of the art. Obviously we come from a place where we would like to see more training, and so forth.

Mr. LAYNOR. I would like to add one more point; that simulator training can be negative also, if the simulator doesn't accurately represent the aircraft or the environment. So the newer aircraft, especially the air carrier aircraft that are being produced, they are generally being concurrently put into service with very sophisticated and high fidelity simulators.

Some of the older aircraft in service, the simulators that are existing have only limited capability and in some cases the ability to represent, for instance, a wind sheer encounter accurately is really limited. And as a result, it may give the flight crew the wrong impression of the type of situation that he is confronted with, rather than provide positive benefit training.

So a lot goes with the fidelity of the simulator, and we feel as though that is becoming part of the FAA simulator approval.

Mr. KING. But I think when we are talking training, I think there is an interesting thesis that has been put forward, if we can keep it in mind. That is: pilots, in fact, do not make decisions, if properly trained. They simply recognize prespecified situations, whether routine or emergency in nature, and respond to them as they have been trained to respond.

And that is why I think, following Mr. Laynor's comment, that is why you want to relate to reality here. In many situations, for example, when we are talking about the American Airlines flight into the Virgin Islands, we said jeepers, what's going on here?

We're talking about split seconds. You no longer have the opportunity to really evaluate and make a judgment. You must respond. You must respond instantaneously. That can only be done by training. That is not the time to be making a judgment and evaluating. You are going down that runway and every second you are talking about puts you in a position where you cannot recover. That is really the essence of the training.

The CHAIRMAN. Senator Kassebaum has some additional questions.

Senator KASSEBAUM. I had another question on the CVR's that I would like to ask. In the San Diego case, who released the recording that was on television shortly after the accident?

Mr. KING. That was the air traffic control tape, and that is FAA. That is a tower tape, as it is called. And that FAA, I gather now, has looked at it—they don't release it any more, but they used to release it as a matter of public record immediately, at the accident site.

Senator KASSEBAUM. They don't any more?

Mr. KING. They have indicated to us they are not. But it is the sort of thing that you could monitor on your own radio if you have the proper frequency band. Many short wave receivers do. So it had been viewed as a public record, whereas the cockpit voice recorder is strictly a working environment. And it is not, in the sense that the public doesn't listen in on that.

Senator KASSEBAUM. I see. So you can pick up the control tower on a CB?

Mr. KING. Yes. On a regular ——

Senator KASSEBAUM. On any of the airwave channels.

Mr. KING. Yes. You can just tune in and listen. Some people enjoy that and that's their background music, as it were. On their trip into work they'll listen to the tower over here at National.

Senator KASSEBAUM. Thank you.

The CHAIRMAN. Thank you very much, gentlemen.

Next we'll hear from Mr. Paul R. Ignatius, president and chief executive officer, Air Transport Association.

Mr. Ignatius, you may proceed.

STATEMENT OF PAUL R. IGNATIUS, PRESIDENT AND CHIEF EXECUTIVE OFFICER, AIR TRANSPORT ASSOCIATION OF AMERICA; ACCOMPANIED BY JAMES LANDREY, GENERAL COUNSEL; AND CLIFTON VON KANN, SENIOR VICE PRESIDENT, OPERATIONS AND AIRPORTS

Mr. IGNATIUS. Thank you, Mr. Chairman and members of the committee. I am pleased to be here this morning. With me, on my right, is James Landrey, who is general counsel of the Air Transport Association; and on my left is Clifton Von Kann, who is senior vice president of operations and airports.

Mr. Chairman, I have a comprehensive statement of some length, and I would like permission to have it entered in full in the record. But I propose to summarize it, in the interest of the committee's time.

The first point I want to make emphasizes the importance of safety to the airlines and present some statistical data from the National Transportation and Safety Board that shows the fine safety record that has been achieved by the airlines over the years and how that excellent record indeed has improved over the period of the last 30 years.

Safety is the highest priority of the airlines. There is no conflict in any way between safety and profitability, for if an airline is not safe or not perceived by the public to be safe, it simply cannot exist as a viable business enterprise.

Mr. Chairman, you asked me to summarize for the committee some of the actions that have occurred since the DC-10 accident in Chicago last year, and I am pleased to do that at this time.

First, I want to stress the fact that this has been a matter of continuing top-management attention. Airlines may be unique in the extent to which operational and safety matters occupy the personal attention of their top management. Each day, it's customary for the chief executive officer to chair an operational meeting that reviews the prior day's operations and any occurrence that have safety implications. Since the DC-10 accident last May, the many actions that have taken place have been with the involvement of and the approval of the highest levels of management in the airlines.

Now, what have these actions been? First, and most important in some respects, has been a series of intense audits of airline operations. First, the airlines themselves have conducted internal audits of their maintenance operations, their quality assurance functions, training activities, and so forth.

Second, the FAA organized a series of in-depth audits of the air carriers, forming in most instances special teams, drawing upon FAA experts from various regions of the country, to go into an air carrier to look at its maintenance operations. For example, at one carrier, the team numbered some 20 individuals and the audit took about 2 weeks.

Third, the air carriers themselves have invited their manufacturers—that is, the producers of their aircraft or engines—to conduct audits of their maintenance operations.

Next, supervision has come in for intensive emphasis. At one carrier, for example, the vice president for maintenance personally conducted a series of meetings for every supervisor, assembled in groups of 20 or so, from 8 in the morning until 6 at night over a period of 18 weeks.

Training has been emphasized, training not only for apprentices, but also for experienced people. New training aids have been developed. Specialized training programs have been formulated.

Technical data is, of course, the "bible," so to speak, from which maintenance operations proceed. Since the Chicago DC-10 accident last year, the airlines have reviewed their tech data systems to insure that all workers performed in accordance with their manuals, that the right people get the manuals, that manual revisions are reviewed and approved by the proper authorities, and that the right people are promptly notified of any manual changes.

The individual airlines have devoted and are devoting attention and funds to integrated maintenance management information systems. One carrier, for example, has a project costing $7 million under way that will produce real time live data; in effect, a real-time log book.

Now, the DC-10 accident highlighted the question of maintenance procedure changes. The relationships among the airlines, the manufacturers, and the FAA have been reviewed and reaffirmed since the DC-10 accident. The approval level in the airlines for maintenance manual changes has been examined. In some instances, responsibility has been clarified, and in other instances it may have been reassigned. The three groups have to work together. Communications can always be improved, but in the last analysis the airlines have the responsibility under the law and must be accountable for the maintenance of the aircraft they operate.

The accident last May in Chicago also highlighted the importance of the exchange of information, so that events occurring at one or more airlines may be known promptly to other airlines. And in this connection, through ATA and individually, the carriers have been working with FAA on the so-called "service difficulty reporting system."

This system has been in effect for some time, but our experts feel in some ways that it is outmoded and imperfect, first, because it requires a great deal of data that is not safety-significant, and second, the process of disseminating this information takes longer than it ought to. We have made suggestions toward its improvement. We are continuing to do that, and stand ready to help in addition, as appropriate.

Now, the quality assurance function in many ways is the key to much of what we are talking about. It's the control to insure that the functional areas are done properly. And a number of changes have occurred or new emphasis placed in this important area. For example, one airline has adopted a system of requiring formal written commitments for quality assurance. Several airlines have added more quality assurance people or have increased departmental budgets, brought additional areas such as training under the purview of quality control.

And I might add that not only in quality control but in training and in maintenance, the airlines have added people, they have increased budgets at a time when generally they have been laying off people and trying to reduce budgets because of the economic reversals that the industry faces at the present time. But they have not done that in these important areas. In some cases, responsibility for quality control has been placed at a higher organizational level or at a different level, such as, for example, the head of engineering rather than the head of production.

Now, so far, I have talked about maintenance and assuring the quality of maintenance. There have been some changes in flight procedures since May of last year, and I describe the change in the climb out procedures that have taken place since then in my written statement.

There also have been a few hardware changes which I also describe in my written stament. These include establishment of life limits for slat drive cables, modification of the stall warning system, changing to flush pylon bolts and switching thrust links from steel to titanium.

Mr. Chairman, these are some of the changes, then, that have occurred since the Chicago accident. There has been a great deal of reexamination and reaffirmation of much of what has been done.

I now want to turn to the next area of my statement, where I have attempted to set forth comments on a number of the questions that have arisen with increasing intensity in the last year or so about airline safety. And I have organized this into several areas: first, the FAA's management of all of this; second, the adequacy of the airport and airway system; third, reliability of the ATC system; and finally, the aircraft certification process.

First, with regard to the organization and management of the FAA, as you know, there are a couple of bills in the House currently that would separate the nonsafety functions from the safety functions of FAA and, in doing so, also remove the promotional mandate which now is contained in the Federal Aviation Act.

My own feeling is that the best way to promote aviation is to insure its safety. So that I don't believe you have a contradictory policy objective in the act as it's currently drafted, but so as to avoid any misconception or to satisfy any concerns on this part, it seems to me that if one wanted to change the act, one could add a further statement to the declaration of policy in section 103, which I provide in my written statement, simply to state that the promotion of safety is the highest priority in air commerce and civil aeronautics.

Other questions have to do with the qualifications that the FAA Administrator and his deputy should have. Clearly, the individuals presiding over this organization must have proven ability and experience. It's a large organization, 57,000 employees; and it's one in which the public must have trust and confidence.

Questions have arisen about the adequacy, or certainly the number, of engineering people in FAA. Generally speaking, when there's a shortage, you tend to centralize people so as to conserve scarce resources. The FAA has moved in this direction by consolidating certification in three places: Transport aircraft at its Seattle office; engines at its Boston office; and general aviation in Kansas City.

Some people feel that while this is a step in the right direction, it would be possible to go farther. And the blue-ribbon panel indeed recommended that there be a central engineering organization, that this would help to attract and hold the qualified people that are needed.

Now, with regard to FAA's planning and management, there has been congressional criticism of some programs. The General Accounting Office in February of this year issued a report that was critical of FAA's organization, management, planning and coordination of programs having to do with safety. The Department of Transportation, in its response to the GAO, differed from some of the recommendations. And it's difficult, I think, for me to form an independent judgment on this without a great deal more work than I have been able to devote to it.

But I would point out that ATA representatives have often called attention to what they felt was inadequate attention to some problems or the need for more urgent handling. The wake vortex problem is one that we think might have benefited from a more urgent sense of management or direction.

In recent congressional testimony, I recommended that FAA be required by the Congress to develop and publish a 10-year systems plan for its airports, indicating what airports and airport facilities need to be acquired, so that the Congress would have a way of measuring against the milestones of such a program the progress toward its attainment.

These are some of the areas, then, in which questions have been raised about the FAA. I would like now to turn to some of the questions about airport and airway capacity, because if the capacity of these two systems are inadequate, they can directly or indirectly affect safety.

Earlier this year, both the Secretary of Transportation and the Federal Aviation Administrator said that looking ahead it may be necessary to ration the use of these facilities because of the greatly increased demand that one could foresee in the next decade. They pointed out in their official documents that most of this increase up to 1990-91 would be in the area of general aviation and that the large increase in the number of general aviation aircraft would impose a severe workload problem on the ATC system.

Today, there are about 193,000 general aviation aircraft, and FAA forecasts that by 1991 that number will increase to more than 300,000. Now, by way of contrast, the commercial airline fleet has tended to remain quite stable. A good round number is 2,500 commercial airliners. If you look back 10 years ago, the number wasn't too different. If you look ahead to 10 years from now, the number will not be substantially different. Give or take 100 airplanes or so, you tend to have a commercial airline fleet of about 2,500.

At the same time, we have carried a greatly increased number of passengers. For example, 10 years ago, we carried something like 170 million passengers. Last year, 10 years later, we carried over 300 million, almost double the size. And we are forecast, by 1980, to carry substantially more than the 300 million or so that we are carrying now.

We have been able to do this by flying these people in bigger airplanes rather than flying more airplanes. And the implications of this for air traffic control and for airport landings and takeoffs are obvious, for the demands on these resources are about the same for a business aircraft carrying several passengers as for an air carrier aircraft carrying several hundred.

Now, the problem, then, is to accommodate the needs of the common carriers, the commercial airliners, the commuter airliners providing public transportation, and at the same time meet the demands of private aviation.

Most people who have looked at the problem believe that the best way to do this is to provide more and better reliever airports in order to avoid the congestion that occurs at the busy air carrier airports. There are funds available to do this. The Congress has recognized this need, and we believe the progress in future years will be more rapid and more extensive than it has been in past years.

I would like now to turn to the reliability of the air traffic control system, a subject that has occupied this committee's attention in the last couple of days. First, I would like to address the extent and seriousness of the reported computer outages. Outages of ATC computers have been described, quote, "as a serious menace to the safety of air passengers," by PATCO, the union which represents air traffic controllers.

On the other hand, the FAA Administrator has furnished data showing that the number of computer outages has decreased, not increased, in the last 2 years, and that the extent of the difficulty has been exaggerated.

The FAA data shows there is an average of one outage—and an outage is defined as an interruption lasting more than 1 minute—there is an average of one per week per center, for the 20 en route centers, and the average duration of an outage is 7 minutes.

Now, how serious is this? First it is important to note that a computer outage is not a radar outage. If the computer is down either for scheduled or unscheduled reasons, the radar continues to operate. The backup radar that is used was the primary system until 1974, when the present computerized system became available.

The computerized system provides certain data automatically that the controller has to obtain by radio from the pilot when the backup system is used. The backup system is an inadequate substitute for the primary system, and if the workload in the sector is heavy there is a greater chance for human error as the controller works to establish manually what was provided automatically by the primary system.

Accordingly, there is a compelling need for a better backup system, one that will give the controller more of the features contained in the primary system. Fortunately, such a system has been developed. The acronym for it is DARC, direct access radar channel. The system is being installed, with all 20 of the air traffic control en route centers scheduled to have it over the period of the next 2 years. This schedule, including the associated training for controller personnel, should be accelerated to avoid problems that can arise when busy controllers must accomplish manually what is done for them automatically in the primary system.

Now, FAA plans to replace its present primary computerized system beginning in the late 1980's. The new system will be costly, with estimates running as high as $3 billion. The replacement is needed for several reasons: To provide additional capacity; to take advantage of improvements in computer technology; and to enable a greater degree of automation.

I would like now to turn to the question of near-misses and collision avoidance. FAA has recently issued a report indicating that at least 126 near-misses classified as critical occurred in the Nation's skies during 1979. I have had my staff analyze these 126 incidents to see how many involved commercial airlines, and only 19 of the 126 involved commercial airlines. The vast majority of them involved general aviation.

Near-misses arise from several causes. In some cases a pilot may encounter an unexpected aircraft, and even though the two aircraft are adequately separated a near-miss is reported because of the surprise element. In other instances, human error or ATC system failure may create a situation where a collision is avoided only by the alertness of the pilots involved.

Since reliance is still based on the so-called "see and be seen" principle in some parts of the ATC system, the airlines have long believed that greater protection is desirable, and they have therefore advocated that the ATC system should provide for controlled separation between airline aircraft and all other aircraft.

Additionally, the airlines have funded prototype flight tests and have advocated the development of a collision avoidance system. The role of such a system is to provide protection in the event of a failure of the air traffic control system or for those areas where the ATC system does not provide protection from collision.

It has taken an excessively long time for the FAA to develop such a system, even when its technical complexities are given their full due. But there is some reason now to believe that the long-awaited system will soon be available. And we urge this committee in its oversight role to keep FAA's feet to the fire.

Now I would like to turn to air traffic controllers, again a subject that has occupied this committee's attention for the past 2 days. Despite the sophistication of computerized radar technology, with its increasing automation, as I have already discussed, the safety of airline passengers depends very much on the skill and dedication of air traffic controllers. The challenge of the job is evident from the waiting list of more than 15,000 individuals who hope to be selected as controller trainees.

The capability that controllers demonstrate in handling large numbers of arriving and departing aircraft efficiently and safely is evident to anyone who has ever visited a busy airport tower. But beneath the surface are tensions that may already have caused threats to safety or that may lead to illegal strikes or slowdowns in the coming months. These possibilities were set forth extensively in a major article in the "Wall Street Journal" on the 2nd of July of this year. The article described an incident where a Braniff aircraft was allegedly directed toward a severe thunderstorm by a controller apparently angry that Braniff was unwilling to give controllers free transportation. The FAA fired the controller. But with PATCO backing he is contesting the action.

Second, the article mentioned a grand jury investigation of the possibility that controllers in New York may have deliberately erased computer information relating to an Aeroflot jet approaching Kennedy Airport with the Soviet ambassador on board.

Third, the article mentioned harrassment of some controllers, including one incident in which an airline aircraft was allegedly directed by a militant controller into close proximity with another airline aircraft, for the ostensible purpose of making it appear that a controller who opposed militant union tactics was at fault.

"We face a very, very serious situation", Langhorne Bond, the FAA Administrator, said in commenting on the controller situation. The seriousness was underscored just recently when controllers at Chicago participated in slowdown tactics which forced delays to more than 600 aircraft in less than 24 hours, causing great inconvenience to thousands of air travelers and wasting more than $1 million of jet fuel.

Such actions by Federal employees are reprehensible. As you are aware, the FAA and the Department of Justice, through the U.S. attorney, have taken legal action to obtain a restraining order barring such illegal actions. A strike or additional job actions of one sort or another appear to be possible on or before expiration of the PATCO contract on the 15th of March next year.

In 1978, you may recall, the controllers were found to have violated a permanent injunction against strikes, slowdowns, or other job actions, and were fined $100,000. And I would like to read a segment from the presiding judge's memorandum and order in connection with that event. I am quoting from the judge:

> Government employment is a privilege which carries with it in many cases, including this, awesome responsibilities. If one undertakes such responsibilities, one has a sworn obligation to fulfil them. If Defendants are dissatisfied with the conditions of the undertaking, the solution, failing negotiation or persuasion, is to seek other employment, not to engage in or to encourage conduct which violates the law or their sworn oaths, at the expense of possible endangerment to the lives of innocent people and the nation as a whole.

That's the end of the quote.

Undoubtedly, this committee, as part of its continuing oversight of air safety and the operation of the air transport system, will want to assure that illegal actions affecting public safety and convenience do not take place and to consider carefully whether any additional legislation is needed or any sense of the Senate resolution.

The next section of my statement comments on the aircraft certification process, another question that has been in the public mind recently. I don't intend to go into that, because I believe the committee intends to look at this matter in connection with the blue ribbon panel hearing at a later date, except to say that one way of measuring the effectiveness of the present system is the product that comes out of it, namely the U.S. aircraft that are the result of the certification process.

We enjoy a preeminent position in world aviation. Our aircraft are predominantly used not only in this country but in the airlines of the world. And accordingly, it's our feeling that the existing process is working well. The blue ribbon panel did make one recommendation with respect to further openness in the process. That's a recommendation that we support.

The final section of my statement deals with human factors. The importance of this subject cannot be overemphasized. Of the 216 accidents that have resulted in fatalities that have occurred since the introduction of jet-powered flight, only 16 have been attributed to failures in the aircraft or to its equipment, with most of the rest attributed to categories of human error.

The committee has heard a great deal of testimony on this subject. I don't want to burden you with additional information, except to highlight maybe one or two things that we are doing. Of course we conduct periodic meetings with safety representatives from our own airline members and other airline members. The airlines participate in the NASA-run aviation safety reporting system. You have heard testimony on that. It's an extremely important program.

Each airline has its own flight crew safety program. Airline flight crew training has been greatly improved through the use of simulators, and simulator training has been further improved by a recent program known as LOFT, line-oriented flight training. This was developed by one of our airline members. This program consists of a typical airline flight from beginning to end, but with certain operational and mechanical problems introduced for training purposes. It supplements the normal traditional training.

The FAA has recently revised its regulations to permit airlines to conduct LOFT. The airline industry has led the way in both the increased use of simulators and in the development of the LOFT program. And we look forward to further refinement of these programs in connection with FAA's proposed new ruling.

I have listed in capsule form a number of other human factor items in my statement. One airline, for example, conducted a 2-year study of its pilot hiring process to determine the relative importance of a number of factors, including prior educational attainment and ability to learn and retain new information.

Several airlines are either today using or considering the use of the flight data recorder to detect out of tolerance performance by the flight crew. There are improved radar displays of weather information, including the use of color to differentiate rainfall density. There are less cluttered instrument charts to avoid human errors associated with lack of clarity.

This is a group effort in the sense that Government and industry, pilots and airlines, NASA, FAA, the Safety Board, private institutions, are all working. In my statement, I indicate a number of these joint efforts.

In summarizing, then, this part of it, the importance of the human factor element cannot be overstressed. The fact that this committee is devoting particular attention to this will heighten the already good effort that's going on, and I am sure lead to even more useful results in this area. This completes my presentation. I thank you for your attention and we're prepared to respond to questions.

Senator **Kassebaum** [presiding]. Thank you very much, Mr. Ignatius, for a very detailed and thoughtful report.

Senator Cannon had to leave for the Rules Committee, so I have some questions he would like asked and some of my own.

I will start with one that he has asked before and that he feels is important regarding the crew complement issue. He wondered what your view would be to his suggestion that we have a hearing and simulation test on the rule to resolve this issue.

Mr. **Ignatius**. First, we heard some of that testimony, and I think that the opportunity to have a hearing is one that is always available. And if the parties involved want to request it, I am sure that it would be held.

There was some objection, I gather, to a rulemaking proceeding expressed by the ALPA representatives if I heard them correctly. I think their concerns were several in nature. I don't know that we have, from our standpoint, a problem with the rule. But in the event that a rulemaking proceeding were instituted, we would certainly want to participate.

Senator **Kassebaum**. At this point, do you feel it would be beneficial to have an independent study made of the whole question of two- versus three-man crew?

Mr. **Ignatius**. Senator Kassebaum, we've recently had an independent study that focused primarily on the certification process that was undertaken by a group of outstanding people over a period of 5 or 6 months, under the auspices of the National Academy of Science.

I would like to know what one would hope to obtain from yet another study, since we have just had this really outstanding one. We have reviewed it preliminarily. And while there are some things in it we may question, we certainly feel it's an excellent report.

The representatives—I believe it was from the manufacturers yesterday said they thought it was an excellent report. The Secretary of Transportation has said that he wants, as a matter of priority, to consider its recommendations to see which ones he would adopt.

So the question I would have is: Do we need another independent study of the certification process when we've already had an excellent one on which the ink is hardly dry?

Senator **Kassebaum**. Did the blue ribbon panel——

Mr. **Ignatius**. That's what I'm speaking of.

Senator **Kassebaum**. That's part of its recommendation?

Mr. **Ignatius**. Yes.

Senator **Kassebaum**. Did they consider the two versus three?

Mr. **Ignatius**. To the best of my knowledge, they did not consider that issue, per se.

Senator **Kassebaum**. Just certification. Would this be something that you would feel would be within their jurisdiction to evaluate that?

Mr. **Ignatius**. I don't have an opinion on that. I would think that question should be addressed to Chairman Low of the panel, or to the Secretary of Transportation, who brought the panel into being.

Senator **Kassebaum**. Does the ATA support the recommendation made at Monday's hearing that all nonessential duties heretofore handled by the cockpit be eliminated?

Mr. **Ignatius**. Senator Kassebaum, when I heard about that upcoming notice of proposed rulemaking in Mr. Bond's testimony on Monday, I asked our people to look into it. Obviously, in the time available, I have not had an opportunity to do anything exhaustive. But I must say, on the basis of what we've been able to develop in the last day or so, it doesn't seem to me that there is any significant use of the cockpit radio for some of the things that we talked about, mainly making reservations for hotels or rental cars, and so forth.

There is some use of the cockpit radio for company purposes or for occurrences that may develop during the flight. For example, if someone gets sick during the flight and needs attention on arrival, the cockpit radio would be used for that purpose. If some provisioning for the next leg of the flight is needed, beyond what had been anticipated in the plan, the radio would be used for that.

Occasionally, I am told there is some use of the radio when the flight is late and there are important connecting flights to be made. There has been some use made of it for that purpose.

But there are the rules governing this and any notion of any gross or substantial use of it for making hotel or automobile reservations, I don't find any indication of that. When the rule comes out, we will certainly look at it. We have expert committees that review and comment on rules of this kind, and we'll certainly do that with regard to this when we have a chance to look at it.

Senator KASSEBAUM. I think there have been incidents, of course, that have been reported where it was a factor.

Mr. IGNATIUS. There may well have been some instances of it.

Senator KASSEBAUM. Whether it would be substantial enough; but on the other hand, when we're making such a close evaluation of these human factors, I would think this would be one that would merit reevaluation as having some possible effect on the probable cause of an accident or potential accident.

Mr. IGNATIUS. We'll look at the rule carefully when it's available to us.

Senator KASSEBAUM. You mentioned the slowdown at O'Hare. Do you feel that a slowdown should be viewed as a questionable safety situation?

Mr. IGNATIUS. Oh, yes. I think they would have the potential for having an adverse effect on safety.

Senator KASSEBAUM. Because of shortage of gasoline?

Mr. IGNATIUS. Change in routings, loitering, directing flights to other areas, any of a number of things that could result, including possibly an attitude that could lead inadvertently—I don't say deliberately, inadvertently to error on the part of the people who provide the air traffic control information. That can happen—as I say, not necessarily deliberately, but it could result from the lack of the disciplined habit of mind which must always prevail in responsible work of this kind.

Senator KASSEBAUM. Regarding my earlier question to Mr. King on the CVR's, do you have any particular feeling in the ATA regarding cockpit voice recorders and whether they should be privileged information; how valuable they are?

Mr. IGNATIUS. The cockpit voice recorder is extremely valuable. It is the source of much important information in the event of an airline accident in determining probable cause in order to avoid accidents in the future. The use of it beyond that is a very sensitive matter. It must be handled with the greatest delicacy.

There are individual rights involved. There are attitudes involved. There are perceptions involved with respect to how it might be used.

I would think that one would want to be very, very careful about the use of the cockpit voice recorder for any purpose beyond the stated purpose for which it is installed in the airplane.

Senator KASSEBAUM. Do you feel if it could be classified as "privileged," it would enhance the pilot's willingness to participate?

Mr. IGNATIUS. Well, there might be some willingness to consider it more. Certainly the representative from ALPA yesterday gave some indication that if there could be assurance that it would not be used for punitive purposes or if some third party in some way would be involved. Some of their lack of enthusiasm—I think that was the term they used—might be withdrawn.

I still think this is an area where one must proceed very carefully.

There's another issue I think here, Senator Kassebaum, that applies. It is very important, with regard to the safe operation of the air transport system, that accountability be clear. The airlines and their managements have the responsibility under law and regulation for providing safe air transportation. There are other people who are involved in it, but in many ways the burden falls on their shoulders.

Therefore, with that responsibility, and the associated accountability, there is a question about how much you want other people monitoring what the airlines themselves are monitoring.

That is to say, the performance of their flight crews. All of the airlines have in their organizational structure key people who are involved in the training of flight crews and the assurance that flight crews maintain habits of safety and outstanding records of performance.

And when problems arise, they try to identify them, to locate them from direct observation, in training programs, through new techniques, such as LOFT simulator training. And that's an important thing, that this exists, and that there is this accountability.

So one needs to look at the question about whether some of the tools that they use for this or other purposes should be made available to outside groups. And I simply say, with something as sensitive as a device that monitors actual performance, as the Chairman of the National Transportation Safety Board said in testimony that preceded mine, there are some delicacies here. And I would think that caution should be the watchword with regard to use beyond that for which it is specifically intended.

Senator KASSEBAUM. What is your opinion of Mr. Bond's proposal that there be a reassessment of aircraft certification after 8, 10 years?

Mr. IGNATIUS. We have not seen specifically what he has in mind with regard to that and would have to reserve any judgment until we have had an opportunity to look at it and, particularly, that our expert committees have had an opportunity to review it.

One of the things, for example, Senator Kassebaum, that I would be interested to know is the extent to which this recurring certification—and as I understand it, it would occur 8 years after the initial certification and presumably at 8-year intervals thereafter—

what would be the result of that? Would changes be made, prospectively, to new aircraft? Or retroactively, to aircraft already in the fleet.

There are provisions now, of course, for changes retroactively through procedures such as the airworthiness directive, which is a mandatory directive on the airlines to comply that may involve, you know, engineering changes and things of that sort to an airplane already certificated.

Since that already is in existence, one would want to know more about what would be the nature of the recertification at the 8-year interval. And we won't know that until we have seen more than we have been able to obtain through the rather brief testimony that was given.

I would make one further comment on it. The blue ribbon panel said that one of the problems at FAA was a lack of sufficient engineering people to keep up with the sophisticated new technologies in order to be able to appraise what manufacturers were doing.

If you're going to recertify, you are going to commit resources already scarce, beyond what you are now doing. So that I think there is a question that ought to be raised with regard to the best use of this available talent.

I have not suggested that it shouldn't be used for that purpose. I'm simply saying that that's a question on which one ought to satisfy oneself before proceeding with the notion of a recertification at 8-year intervals.

Senator KASSEBAUM. You touched on this a bit in the other answer, but it's one Senator Cannon had wanted to ask. What are your views of Mr. Bond's proposal to make LOFT a requirement.

Mr. IGNATIUS. To the best of my knowledge, LOFT was developed by one of our ATA member airlines. It's being pursued by a number of our airlines today. As prior testimony has indicated, it offers a lot of—it offers a lot of promise of value, and it provides an opportunity to give training in areas where it would be difficult to accomplish such training through actual flight.

The burden of the question was whether it was proceeding as rapidly as it should, and should it be accelerated. I don't know. It seems to me it is moving fairly rapidly. There are some inherent limitations right now. It takes a long time to get a new simulator. The current order and delivery time is from 24 to 30 months.

Another inhibiting factor is getting the very skilled programers who have to program these simulators, and they are people in short supply.

I think it's important that the pressure to move ahead be maintained. And that, in fact, is occurring. Recent regulations and rulemakings have either been issued or are currently being issued. I don't know—it's my impression that it's going ahead at a pretty good pace.

I'd like to ask Mr. Von Kann if he'd like to add to what I've said.

Mr. VON KANN. No, Senator. Of our 29 carriers, 9 that we have been able to pull have LOFT programs or are moving into them. And I think Mr. Ignatius covered the subject well.

Senator **Kassebaum**. So you feel at this time that it wouldn't be anything that should necessarily be a requirement for all airline pilots?

Mr. **Von Kann**. The Administrator didn't say that, as I recall, in his testimony.

Senator **Kassebaum**. I'm wondering, given the fact that there has been such—on behalf of everybody who has testified—support for the program and citing the potential safety benefits, if you feel that it would enhance safety factors to require this of all airline pilots?

Mr. **Von Kann**. I would put it this way, Senator: Your objective here is to keep flightcrews from going beyond their own human limits or putting the airplane beyond its structural limits, depending on the situation. And we have led the way in all this work. Our carriers are tremendously enthused about the use of simulator tools and the LOFT program, which of course has to have a simulator.

So, we bow to nobody in our enthusiasm for the technology. At the same time we have got to remember that looking at the objective here, the objectives of this kind have been achieved even before you had simulators.

One of the most outstanding safety performances in history was the operation of Western Airlines in and out of Alaska during World War II. The conditions were terribly primitive. If they had any simulators, they were Link-type simulators. Navigational aids, very primitive; or sometimes nonexistent. Terrible conditions for the flight crews, as far as their rest periods at the other end. And yet, over that period Western had no accidents.

The point is that somehow they had learned to achieve this objective of keeping the operation of the plane within the limits of the crews and the hardware. To the extent that LOFT helps you to do this, well and good. But it is not the panacea to everything.

For one thing, Chairman King mentioned the training of a crew. This is great, highly desirable. But under the current contracts with the unions, you don't keep that crew together in revenue operation because the pilot reports and the first officer will report, whose turn has come up on the roster. So again, there is a limit to what it can do.

Now, I think to summarize, we are terribly enthused about it. I would say our carriers are moving as rapidly as they can. And as the computer technology and availability of skilled personnel allows—and at the same time they have got to recognize that it is a useful tool and not the solution to all our safety problems.

Senator **Kassebaum**. Thank you very much.

Mr. **Barclay**. Mr. Ignatius, could we go back to the cockpit voice recorder. I am a little unclear about your opinion of the rule that is proposed. Considering the fact that Congress and the CAB, and especially all Government people with responsible positions today, have said we are going to make our decisions—there are important decisions, we are going to make them in the open with a public inspection; why shouldn't a pilot on a normal line operation, when he hasn't been given advance notice that there is going to be an inspector on board with him, be open to that same kind of potential inspection from the FAA which is regulating safety?

Mr. **Ignatius**. In the event of an accident, of course, he is. The Safety Board obtains copies of the cockpit voice recorder when that happens.

The question is: Can it be, or should it be, provided as a matter of routine? I have already said that there are a lot of sensitivities involved with regard to that kind of information, as well as the consideration of the accountability of the airlines that are involved; and that this is an area where I would think if one wants to use it for purposes beyond the stated purpose, that work should go very, very slowly. And that was my response to Senator Kassebaum and is my response to you.

I think this is a very, very delicate matter. It seemed to me, if I heard Mr. King correctly, even he acknowledged that point when he said he wasn't sure that anyone would willingly be interested in having available generally, at 30-minute intervals, everything he did and said in each half-hour period during the day. I think there is some sensitivity.

Now, it may be—we haven't seen the rule. We don't know what they have in mind. It may be that there would be some ways to safeguard information through third parties, or through some means not now available or contemplated, that could ameliorate some of these concerns. But I think that one would be well advised to proceed with caution in this area, because you can—it's a delicate situation and the sensibilities can be exacerbated if one doesn't proceed with a great deal of delicacy.

Senator **Kassebaum**. I certainly concur with you, Mr. Ignatius. I think it is very important for us to approach this with some caution and balance out against just how much it will add to our evaluation of the human factor and safety conditions that we need to study.

I would certainly like to commend the blue ribbon panel. From the testimony that you gave I think the recommendations are going to be extremely beneficial and important to us, and I thank you for your testimony today.

Mr. **Ignatius**. Thank you.

[The statement follows:]

STATEMENT OF PAUL R. IGNATIUS, PRESIDENT AND CHIEF EXECUTIVE OFFICER, AIR TRANSPORT ASSOCIATION OF AMERICA

INTRODUCTION

In his letter of June 24, 1980 transmitting the report entitled "Improving Aircraft Safety"—the so-called "Blue Ribbon Panel" report—Phillip Handler, President of the National Academy of Sciences, said: ". . . had we been evaluating the regulation of a different technology, aircraft safety could appropriately have been employed as a standard of excellence for comparison."

And in his transmittal letter to Dr. Handler, George M. Low, Chairman of the Panel, said: ". . . the nation's commercial air travel system is the standard of the world for safety, dependability, and comfort."

Both Dr. Handler and Chairman Low also pointed out that it was possible to make a very good system even better. They said that merely standing pat was an inadequate response to the challenge of the future.

It is in this spirit of pride in what has been accomplished and determination to avoid complacency about the future that the airlines approach this hearing on aircraft safety. In the course of our testimony we will: Summarize the safety record of the airlines; indicate actions the airlines have taken since the accident in Chicago on May 25, 1979; address the principal questions about aircraft safety that have arisen over the past year or so; discuss the role of human factors in air safety; and in connection with the above, comment on some of the recommendations of the Blue

Ribbon Panel, recognizing that more detailed examination of this important report may be the subject of a separate hearing.

THE AIRLINE SAFETY RECORD

Safety is the highest airline priority.

The airline industry became a practical possibility when it became evident that people could travel safely in an airplane.

The airline industry grew to its dominant position today because the travelling public was confident about airline safety.

The industry's future growth and prosperity are directly linked to a continuing perception by the public that air travel is safe.

Thus, there is no conflict between safety and profitability, for if an airline is not safe or not perceived by the public to be safe, it simply cannot exist as a viable business enterprise.

Over the past thirty years, scheduled airline safety has improved dramatically no matter how it is measured, as indicated in the table below:

U.S. SCHEDULED DOMESTIC AND INTERNATIONAL PASSENGER SERVICE

	Fatal accidents per million aircraft miles	Passenger fatalities per million aircraft miles	Fatal accidents per 100,000 aircraft departures
1950–54	0.012	0.210	0.247
1955–59	.008	.178	.190
1960–64	.007	.183	.189
1965–69	.004	.107	.160
1970–74	.003	.084	.113
1975–79	.001	.037	.060

Source: National Transportation Safety Board.

AIRLINE ACTIONS SINCE MAY 1979 CHICAGO ACCIDENT

1. Introduction

The Chairman of the Senate Aviation Subcommittee has asked us to comment on actions that the airlines have taken since the fatal DC–10 accident at Chicago's O'Hare Airport on May 25, 1979. This event precipitated the request by the Secretary of Transportation for the Blue Ribbon Panel study, and was the focus of several Congressional hearings.

We are pleased to enumerate the actions that the airlines have taken, but it is important to make a general comment before proceeding. The outstanding safety record of the airlines, which I have already described, is primarily the result of a continuing, intensive, top to bottom emphasis on safety, and not because of any special actions that may arise from a particular event. Nevertheless, the Chicago accident raised some especially difficult questions that led to comprehensive safety reviews and heightened emphasis in a number of areas. It is not possible within the compass of testimony of reasonable length to describe all that has been done, but the material which follows should give the Committee a good picture of the constructive activity that has occurred since May 1979.

2. Top management attention

Airlines may be unique in the extent to which operational and safety matters occupy the personal attention of top management. Typically, the Chief Executive presides over a daily morning meeting that reviews the previous day's operations, including any occurrences with safety implications.

Since the DC–10 accident, the actions that airlines have taken have been at the insistence of and with the full support of top management. Often, this has meant approval of additional personnel and budget increases for safety-related functions at a time when economic reversals have caused a good deal of airline retrenchment.

3. Audits

Audits of airline maintenance operations have been conducted with increased intensity since the Chicago accident.

First, the airlines themselves have conducted internal audits of their maintenance operations, quality assurance functions, training programs, and other safety-related activities. The results of these audits have varied from airline to airline, but in general they have led to a number of changes in organization and procedures to enhance airworthiness and safety.

Secondly, the FAA has undertaken a series of in-depth special audits of airline maintenance and quality assurance activities. These FAA audits have typically involved team members from regions outside the FAA region in which the air carrier is located, and with experts in many technical areas. In one instance, for example, the team consisted of 20 people who devoted two weeks to the audit. The audit effort has been system-wide, covering not only the carrier's headquarters operations but also base maintenance, line check stations, and so forth.

Thirdly, air carriers have asked manufacturers of the aircraft they fly to conduct audits of their maintenance operations and procedures, including, for example, engine change procedures. These special manufacturers' audits have supplemented the day-to-day liaison with the manufacturers' product support organization coordinated through the manufacturer's representative in residence at the airline.

4. *Supervision*

Front-line supervision plays a key role in assuring that individual mechanics are properly qualified and performing their assigned task in accordance with approved procedures.

Since the Chicago accident, there have been more supervisor meetings to reemphasize the importance of quality assurance. For example, the Vice President for Maintenance of one ATA airline personnaly conducted the meetings for every supervisor, assembled in groups of 20 or so, from 8:00 a.m. to 6:00 p.m., one day a week, over a period of 18 weeks. Other airlines have made similar efforts.

5. *Training*

Additional emphasis on training since the Chicago accident has taken several forms.

First, new training aids and mock-ups have been developed to improve the effectiveness of instruction.

Secondly, training programs have been intensified at some carriers, inlcuding training for apprentices as well as mechanics and supervisors. Often, this has meant assigning more people and money for training. It has also increased the percentage of an employee's time devoted to training.

Thirdly, the effort has included specialized training programs designed to solve a particular problem. For example, one carrier follows the practice of calling together five or ten mechanics from its major stations to develop a special program for dealing with a specific maintenance problem. When the program is developed, the mechanics who helped to develop it go out into the field to instruct their fellow employees. While this program did not result directly from the Chicago accident, it is an example of a quick response mechanism that airlines have developed to deal with problems that arise from operational use of aircraft.

6. *Technical data*

The airlines are responsible for maintaining their aircraft in accordance with maintenance manuals, work cards, and other technical data which provide FAA-accepted maintenance standards. Since the Chicago DC-10 accident last year, the airlines have reviewed their technical data systems to insure that: All work is performed in accordance with their manuals; the right people get the manuals; all manual revisions are reviewed and approved by the proper authorities; and the right people are promptly notified of any manual changes.

Where action was required, the airlines added technical data personnel and new controls and procedures.

Through ATA, the airlines have fostered the development of specifications for improved technical data for: fault reporting and fault isolation manuals; task oriented maintenance manuals; and avionics manuals.

Individual airlines have devoted major attention to development of integrated maintenance management information systems. One carrier, for example, has a $7 million project of this kind underway that will store and display real-time log book reports, aircraft, engine, and component reliability data, and other necessary technical information.

7. *Responsibility for maintenance procedure changes*

The DC-10 accident last year highlighted the area of maintenance procedure changes.

Under the law, the airlines are directly accountable for the reliability and safety of their operations. The Federal Aviation Act and the Federal Air Regulations (FAR's) make airlines responsible for assuring that proper maintenace procedures are performed by qualified mechanics. The aircraft, engine and component manufacturers furnish the initial maintenance manuals for their products, and the airlines incorporate these initial manuals into their technical data systems before a new aircraft is put into service. The manuals are required by ATA Specification 100 to include adequate warnings and cautions to prevent injury to personnel and damage to equipment.

As experience is gained with new aircraft, the initial manuals are revised to reflect operational use and airline maintenace expertise. Maintenace manual revisions are provided to FAA as required by the regulations. The manufacturer is routinely consulted by the airline when his expertise is needed and many individual airline developed changes are subsequently adopted by the manufacturers as common standards or alternative standards. Thus, knowledge gained by one airline is available to other airlines through the manufacturer's periodic manual revisions.

These fundamental relationships have been reviewed and reaffirmed by the airlines since the Chicago accident. The approval level in the airlines for maintenance manual changes has been examined, and in some instances decision authority has been clarified or reassigned. The airlines recognize that the FAA and the manufacturers play an important role in the review of safety-significant maintenance procedures, and believe that communications among the three groups can be improved. But to preserve accountability under the law, the basic responsibility rests with the airlines.

8. Safety information excange

The Chicago DC-10 accident highlighted the importance of a prompt exchange of safety information so that all airlines will know when a difficulty arises at one or more airlines. As a result, ATA and the International Air Transport Association (IATA) provided the FAA with free access to the airline domestic and international telecommunications systems for faster dissemination of safety information, airworthiness directives in particular.

Acting individually and through ATA, the airlines have reviewed the present safety information system pertaining to service difficulties and formulated a number of concepts and recommendations for its improvement. Here are some of the conclusions from this review:

Aircraft and engine manufacturers have an obligation to maintain a world-wide product support communications system for their customers. Accordingly, the manufacturer is the most important contact point about safety-significant aircraft or engine incidents or observed difficulties.

U.S. airlines and U.S. manufacturers are required by regulation to notify the FAA of safety-significant service difficulties within 24 hours after their discovery. The FAA is responsible for issuing mandatory corrective action when necessary.

The current FAA Service Difficulty Reporting System is imperfect and outmoded because (i) it requires reports on many items that are not safety-significant, and (ii) the process of disseminating the information is too time-consuming.

The airlines believe that FAA's safety reporting system needs to be modernized. They have contributed through ATA to the initial work on this modernization effort, and they stand ready to provide additional help when needed.

9. Quality assurance

A major area of concentration among the airlines since the Chicago accident has been the quality control and quality assurance function. The review of this important responsibility has led to a number of changes:

One airline has required formal written commitments for quality assurance.

Several airlines have added more quality assurance people, increased departmental budgets, and brought additional areas, such as training, under the purview of quality control.

Responsibility for quality control in some instances has been placed at a higher organizational level, or in other instances, at a different level as, for example, the head of engineering instead of the head of production.

Added emphasis has been placed on quality awareness programs.

10. Flight procedures

The flight procedures for climb out at the time of the Chicago accident were based on the desirability of achieving optimum climb gradient after lift-off. These procedures, which were recommended by the manufacturer and submitted to FAA, reflected risk assessment based on experience up to that time. The unprecedented chain of events leading to the Chicago accident caused a further examination of these procedures and a reassessment and rebalancing of risk factors. As a result, all airlines now use a climb airspeed schedule for the engine out condition that modifies the airspeed depending upon the point at which the thrust loss occurred. This provides an extra factor of safety against stalls without any significant increase in risk on the altitude side.

11. Hardware changes

Several hardware changes are being completed on the DC-10 by the airlines as a result of a series of FAA airworthiness directives. These include establishment of life limits for slat drive cables, modification of the stall warning system, changing to flush pylon bolts and switching thrust links from steel to titanium.

12. Conclusion

The mark of a good organization, whether it be a business enterprise, an academic institution or a government agency, is a capacity for critical self-analysis. The airlines' outstanding safety record testifies to the quality of their employees and procedures concerned with safety. The reexaminations of existing practices, organizational assignments, and coordination methods that have occurred since the Chicago accident are further evidence, for they show a willingness to look critically at what has been done for the purpose of determining if it can be done better.

PRINCIPAL QUESTIONS INVOLVING AIR SAFETY

In this section of my testimony, I will comment upon a number of safety questions that have arisen with greater intensity in the past year or so, grouped under the topics listed below. Blue Ribbon Panel recommendations will be mentioned where appropriate.

Organization and Management of FAA
Adequacy of Airport and Airway Capacity
ATC System Reliability
Aircraft Certification Process

1. Organization and management of FAA

As the regulator of air safety, FAA has been the target of many Congressional and public inquiries as to whether it is properly organized and managed to carry out its important responsibilities.

(a) *Separation of Safety and Non-Safety Functions.* Two bills have been introduced in the House that would confine FAA to safety matters, with its other functions assigned to separate entities. FAA's mandate under the Federal Aviation Act of 1958 to "promote" aviation would be eliminated under these legislative proposals, in the belief that safety and promotion of aviation are in conflict.

The airlines think it would be difficult to separate FAA's functions into safety and non-safety categories. For example, administration of the airport grant program might be regarded by some as a clear instance of a responsibility that has nothing to do with safety. On the other hand, the grant program is very much concerned with the provision of adequate reliever airports to improve safety by reducing congestion at some of the major air carrier airports. Thus, it is questionable if safety would be enhanced by assigning the airport grant program to another organizational entity, quite apart from questions as to the administrative desirability of fractionating FAA's overall aviation responsibilities.

FAA's "promotional" mandate arises from the Federal Aviation Act, which addresses the matter in two places. First, the Act's policy declaration in Section 103 states that air commerce should be regulated so as "to best promote its development and safety". Since, as I have stated earlier, the best way to "promote" aviation is to assure its safety, the two objectives in the policy declaration are not contradictory.

Section 305 of the Act is also pertinent. This section directs the Secretary of Transportation to "encourage and foster the development of civil aeronautics and air commerce in the United States and abroad". Since civil aeronautics and air commerce serve useful functions in this country and overseas, their continued encouragement would appear to be very much in the public interest.

So that there can be no misunderstanding as to the primacy of safety, however, we recommend that Section 103 be amended by the addition of a new sub-section (a) as follows:

(a) *The promotion of safety as the highest priority in air commerce and civil aeronautics.*

Existing sub-sections (a) through (e) could then be redesignated as (b) through (f).

(b) *Selection and Qualifications of the FAA Administrator.* The Administrator of the FAA presides over a large technical organization (57,000 employees) that operates the Air Traffic Control System, conducts rulemaking affecting safety, certificates airmen, aircraft, and airports to assure the highest standards of aviation safety, and carries out other important functions.

Clearly, the public interest requires that the Administrator and the Deputy be individuals of proven experience and ability, able to lead a technical agency with competence and public trust. In commenting on this requirement, the Blue Ribbon Panel recommended that the President select the Administrator and the Deputy from a slate of candidates recommended by a proposed Aviation Safety Policy Board, and that such individuals be reappointed when appropriate.

The airlines strongly endorse this recommendation.

(c) *Attraction and Retention of Competent Technical Personnel.* Like many other observers, the Blue Ribbon Panel was concerned about FAA's continuing ability to attract and hold engineers and technicians with the skills needed for aircraft certification. The Panel recommended that FAA establish a central engineering organization, responsible for type certification and participation in rule-making, as a means for assuring the availability of qualified engineering experts.

As a general rule, it is desirable to centralize responsibility when resources are scarce. Thus, if competent engineers are in short supply, their effectiveness can be enhanced if they are consolidated rather than dispersed. FAA has recognized this need in part by assigning certification of transport aircraft to its Seattle office, aircraft engines to its Boston office, and general aviation aircraft to its Kansas City office.

In addition to making the best use of available resources, the Blue Ribbon Panel believes that a central engineering organization is needed because specialists of high calibre are not likely to be attracted to the current organization.

The airlines support the recommendation for a central engineering organization and are prepared to assist, as appropriate, in helping to identify individuals with the necessary qualifications from educational institutions, engineering laboratories or industry. At this point in our review of the recommendation, however, we tend to think that the central organization should be confined to type certification, with the continuing airworthiness function carried out through the regional offices in the normal manner.

(d) *Improved Planning and Project Management.* In its report of February 29, 1980 entitled "How to Improve the Federal Aviation Administration's Ability to Deal with Safety Hazards", the General Accounting Office was critical of FAA's ability to identify potential safety hazards, and to organize, plan, manage, and coordinate individual safety programs and projects.

It is not possible, without much more detailed analysis, to form an independent judgment of the GAO's findings. The Department of Transportation has responded to the report, and GAO has acknowledged that some of the actions that have been initiated within FAA have the potential for improving FAA operations. But the GAO clearly believes that more needs to be done.

On a number of occasions, ATA representatives have called attention to the need for improved management and a greater sense of urgency with respect to specific FAA programs. For example, the work on wake vortices has gone on for a number of years with very little in the way of accomplishment. The project certainly needs a better sense of direction.

In recent testimony before the Congress, ATA called for development and publication by FAA of a 10-year system plan for acquisition of airport and airway facilities. The plan would be updated and resubmitted annually to the Congress and would provide a means for identifying needs and monitoring progress toward their fulfillment. It would also enable more rigorous project management of important FAA programs, a deficiency that both the GAO and the airlines have noted.

(e) *Advisory Committees.* In past years, government/industry committees or task forces were often formed to find prompt solutions to technical problems that could directly or indirectly affect safety. The process of assembling such a team, however, has been hampered by the procedural restraints of the Federal Advisory Committee Act, and as a result, this problem-solving method is now seldom used. My colleague, Clifton F. von Kann, an ATA Senior Vice President, has recently pointed out in House testimony that the Central Intelligence Agency and the Federal Reserve System were exempted from the provisions of the Federal Advisory Committee Act. Because of the FAA Administrator's responsibility for safety, General von Kann said no government official had a better right to call groups together on short notice. Accordingly, we recommend legislative action to amend the Act to exempt the FAA. Because of the public's interest in safety, the meetings should be open, but openess should not be allowed to interfere with the need for prompt and effective solutions.

2. Airport and airway capacity

Insufficient airport and airway capacity limits the ability of the air transport system to accomodate the demands placed upon it, and can adversely affect safety. Therefore, it is important to address the matter in these hearings.

Earlier this year, both the Secretary of Transportation and the Federal Aviation Administrator said that in the future it might be necessary to control demand and allocate airport and air space use. In forecasting future demand, FAA stated in its Aviation Forecasts for Fiscal Years 1979-1990, dated September 1978, that: "The growth in general aviation would impose the greatest new burden on the Air Traffic Control (ATC) system. By their sheer numbers and increasing electronic sophistication, general aviation would become the primary ATC workload in enroute as well as in terminal airspace."

In their subsequent 1979 forecast covering 1980-1991, FAA predicted that the general aviation fleet would grow from about about 193,000 aircraft in 1979 to 303,800 in 1991, a 57 percent increase. The greatest rate of growth would occur in the turboprop and turbojet categories, the types of aircraft used widely for business purposes. FAA believes turbojet aircraft will increase from 2,600 to 6,400, an increase of 146 percent. These expensive, sophisticated aircraft, typically flown by professional pilots, tend to operate at the major airports where capacity is most strained. Today, the corporate jet fleet is about the same size as the air carrier fleet, but it will be more than double the size of the air carrier fleet by 1991. If FAA estimates for turboprop aircraft are added to the turbojet numbers, the corporate fleet will be over four times the size of the air carrier fleet.

By way of contrast, the number of aircraft operated by U.S. scheduled airlines has remained remarkably stable. In 1979, air carriers operated 2,542 fixed wing aircraft; in 1978, the figure was 2,263; ten years before that, in 1968, the total was about the same, namely, 2,297 aircraft.[1]

In 1979, ATA carriers transported 317 million passengers; ten years earlier, in 1969, only 172 million passengers were carried. The airlines were able to nearly double the number of passengers carried with a fleet that has stayed at about the same number of aircraft because the aircraft have grown in size. In short, the airlines have accommodated growth by using bigger airplanes rather than using more airplanes. The implications of this for air traffic control and airport landings and takeoffs are obvious, for the demands on these resources are about the same for a business aircraft carrying several passengers as for an air carrier aircraft carrying several hundred.

The problem that must be addressed is how the demands of the corporate jet fleet and other private aircraft can be met without adversely affecting the safe and efficient operation of the air carriers engaged in public transportation, including the growing number of commuter carriers providing essential service to small communities. The airlines have for many years advocated the development of general aviation airports, suitably located in metropolitan areas, to attract a maximum volume of general aviation activity away from air carrier airports.

There is general agreement today within all areas of civil aviation, the FAA, and the Congress on the urgent need to move forward with a comprehensive reliever airport program. Such a program would ease congestion and help avoid tragedies such as occurred at San Diego when a collision between a small private plane on a training flight and a large commercial airliner led to the death of 144 people. The reason the student pilot was practicing instrument landings at the San Diego Airport was that there was no reliever airport in the immediate area instrumented for IFR (Instrument Flight Rules) approaches. A comprehensive reliever program would ensure that such relatively inexpensive instrumentation was available where needed.

3. ATC system reliability.

In recent months Members of Congress and the press have raised questions about the reliability of the Air Traffice Control System, the dependability of its computers, the professionalism of the air traffic controllers, and the availability of improved technical means for avoiding collisions.

(1) *Extent and Seriousness of Reported Computer Outages.* Outages of the ATC computers have been described as "a serious menace to the safety of air passengers" by PATCO, the union which represents air traffic controllers. The FAA Administrator, on the other hand, has provided data showing that the number of computer outages has decreased, not increased, in the last two years, and that the extent of the difficulty has been greatly exaggerated. FAA data show an average of one outage—an interruption lasting more than one minute—per week per center for the 20 enroute centers. The average duration of the outage is seven minutes.

It is important to note that a computer outage is not a radar outage. If the computer is down, either for scheduled or unscheduled reasons, the radar continues to operate. The backup radar that is used was the primary system until 1974 when the computerized system became available. The computerized system automatically provides alpha-numeric data (aircraft identification, altitude, ground speed, etc.) that the controller has to obtain by radio from the pilot when the backup system is used.

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[1] FAA estimates that the number of aircraft operated by air carriers will increase by about 21 percent in the next ten years or so, but much of the increase is attributable to definitional changes, with some commuters becoming air carriers during the 1980's that were not included in FAA's 1979 base data. The air carrier fleet is expected to grow only about 5-6 percent, or 125-150 aircraft.

The backup system is an inadequate substitute for the primary system, and if the workload in the sector is heavy, there is a greater chance for human error as the controller works to establish manually what was provided automatically by the primary system.

Accordingly, there is a compelling need for a better backup system, one that will give the controller more of the features contained in the primary system. Fortunately, such a system has been developed. Called DARC (Direct Access Radar Channel), this system is now being installed, with all 20 of the centers scheduled to have it within a two-year period. This schedule, including the associated training of controller personnel, should be accelerated to avoid the problems that can arise when busy controllers must accomplish manually what is done for them automatically in the primary system.

FAA plans to replace its present primary computerized system beginning in the late 1980's. The new computer system will be costly, with estimates running as high as $3 billion. The replacement is needed to provide additional capacity, to take advantage of improvements in computer technology, and to enable a greater degree of automation.

(2) *Near Misses and Collison Avoidance.* In recent weeks, there have been reports of a number of near misses, and these are a cause of deep concern. On Wednesday, August 6, 1980, for example, a single-engine Cessna 190 aircraft came within 100 feet of a PSA-727 jet carrying 43 passengers on its final approach about 4½ miles east of Oakland International Airport.

The Oakland incident was similar to others that have occurred, recalling the tragic mid-air collision described earlier between a Cessna and a PSA jet in San Diego. In urging use of FAA's emergency authority to improve safety in the San Diego area, I wrote the FAA Administrator on December 18, 1979 stating: "It is now 15 months since the mid-air collision in San Diego. Too little has been done to prevent a recurrence of this type of accident. The NASA Aviation Safety Reporting System team advises that since the mid-air in September 1978, there have been 34 near-miss reports at San Diego."

After considerable delay, not entirely of FAA's making, improved control procedures were implemented in the San Diego area. But despite this and other efforts that FAA has made, the problem has continued. FAA has recently issued a report indicating that at least 126 near-misses, classified as critical, occurred in the nation's skies during 1979.

Near-misses arise from several causes. In some cases, a pilot may encounter an unexpected aircraft, and even though the two aircraft are adequately separated, a near-miss is reported because of the surprise element. In other instances, a human error or ATC system failure may create a situation where a collision is avoided only by the alertness of the pilots involved. Since reliance is still based solely on the so-called "see and be seen" principle in some parts of the ATC system, the airlines have long believed that greater protection is desirable and have therefore advocated that the ATC system should provide for controlled separation between airline aircraft and all other aircraft.

Additionally, the airlines have funded prototype flight tests and advocated the development and installation of a collision avoidance system (CAS). The role of the CAS is to provide protection in the event of a failure of the ATC system, or for those areas where the ATC system does not provide protection from collision. It has taken an excessively long time for FAA to develop such a system, even when its technical complexities are given their full due. There is some reason now to believe that the long-awaited system will soon be available, but we urge this Committee in its oversight role to keep FAA's feet to the fire.

(3) *Air Traffic Controllers.* Despite the sophistication of computerized radar technology with its increasing automation, the safety of airline passengers depends very much on the skill and dedication of air traffic controllers. The challenge of the job is evident from the waiting list of 15,000 or more individuals who hope to be selected as controller trainees. The capability that controllers demonstrate in handling large numbers of arriving and departing aircraft efficiently and safely is evident to anyone who has visited a busy airport tower.

But beneath the surface are tensions that may already have caused threats to safety, or that may lead to illegal strikes or slowdowns in the coming months. These possibilities were set forth in a major article in the Wall Stree Journal on July 2, 1980. The article described:

An incident where a Braniff aircraft was allegedly directed toward a severe thunderstorm by a controller apparently angry that Braniff was unwilling to give controllers free transportation. The FAA fired the controller, but with PATCO backing, he is contesting the action.

A grand jury investigation of the possibility that controllers in New York may have deliberately erased computer information relating to an Aeroflot jet approaching Kennedy Airport with the Soviet ambassador on board.

Harrassment of some controllers, including one incident in which an airline aircraft was allegedly directed by a militant controller into close proximity with another airline aircraft for the ostensible purpose of making it appear that a controller who opposed militant union tactics was at fault.

"We face a very, very serious situation," Langhorne M. Bond, the FAA Administrator has said in commenting on the controller situation. The seriousness of the situation was underscored this month when controllers at Chicago participated in slowdown tactics which forced delays to more than 600 aircraft in less than 24 hours, caused great inconvenience to thousands of air travelers and resulted in the waste of more than $1 million worth of fuel. Such actions by Federal employees are reprehensible. As you are aware, the FAA and the Department of Justice, through the office of the U.S. Attorney for the Northern District of Illinois, moved quickly to seek and obtain a Federal Court temporary restraining order barring these illegal actions.

A strike or additional job actions of one sort or another appear to be possible on or before expiration of the PATCO contract on March 15, 1981. In 1978, the controllers were found to have violated a permanent injunction against strikes, slowdowns, or similar job actions, and fined $100,000. In his Memorandum and Order dated July 17, 1978, the presiding Federal Judge, Thomas C. Platt of New York, stated: ". . . Government employment is a privilege which carries with it in many cases, including this, awesome responsibilities. If one undertakes such responsibilities, one has a sworn obligation to fulfill them. If defendants are dissatisfied with the conditions of the undertaking, the solution, failing negotiations or persuasion, is to seek other employment, not to engage in or encourage conduct which violates the law or their sworn oaths at the expense of and possible endangerment to the lives of innocent people and the nation as a whole."

Undoubtedly, this Committee as part of its continuing oversight of air safety and the operation of the air transport system will want to insure that illegal actions affecting public safety and convenience do not take place, and to consider carefully whether additional legislation is needed.

(4) *The Aircraft Certification Process.* At a later date, it is our understanding that the Committee will carefully review the report of the Blue Ribbon Panel, devoting particular attention to the aircraft certification process, the major subject of the Panel's report. Accordingly, it is not our purpose today to comment in great detail on aircraft certification or the Panel's recommendations concerning certification.

We do wish to state, however, that we believe the Secretary of Transportation performed valuable public service when he appointed the distinguished panel. I commended the Secretary at the time, stating in my letter of December 20, 1979: "On behalf of the scheduled airlines, let me express our appreciation of your announcement of a high-level panel to review aviation safety issues. Nothing is more important to the airlines than safety, and you can be assured that we will support the work of the panel in every possible way."

While there are some points on which we differ with the Panel's recommendations, the airlines believe that overall the report constitutes an impressive piece of work that will make important contributions to aviation safety.

Since one aspect of the aircraft certification process—the degree to which it should be "opened"—has been a matter of some public attention in recent weeks, it is appropriate to make a brief comment at this point in the Committee's safety hearings. With regard to "openness", the Panel said:

"We find that much of the debate on the subject of openness involves a confusion between the right of the public to be heard in setting new standards (which is a formal rulemaking function in which the public clearly has the right to participate) and the desire of the public to appear before, or even become voting members of the Type Certification Board."

After considering the need for a more open process, the Blue Ribbon Panel made one recommendation—that FAA should publish, as a notice in the Federal Register, the availability of the FAA approved preliminary regulatory and certification basis for new aircraft type design, with subsequent publication of changes thereto, to permit timely review and comment by the public and response from the FAA.

The airlines believe that the existing certification process is working well and has contributed in a major way to the preeminence of U.S. aircraft. The Panel's recommendation on openness is supported by the airlines.

HUMAN FACTORS IN AIR SAFETY

1. Introduction

The Chairman stated his desire to discuss human factors in air safety when he announced these hearings. The importance of the subject is evident from the following excerpt from the report of the Blue Ribbon Panel:

"Since the introduction of jet-powered flight in 1958, U.S. air carriers have been involved in 216 accidents resulting in fatalities. Only 16 of these were attributed primarily to failures of a jet aircraft or its equipment, according to data from the National Transportation Safety Board, which is responsible for investigating and assignment of probable cause to airplane accidents. The balance was attributed to the categories of human error in flight and the air traffic control system."

In responding to the Chairman's request, I will discuss some of the human factors efforts that the aviation community and governmental agencies are carrying out. We would be pleased to make available our technical experts for further discussion with the Committee and its staff.

There is widespread acceptance of the view that intensified work in the area of human factors has the greatest potential for improving aviation safety. By "human factors," we refer to those things which cause or permit a person to do something (or fail to do something) that contributes to an unsafe situation. In short, the purpose of the human factors effort is to reduce the human errors which cause aircraft accidents.

The humans we are talking about are pilots, of course, but also air traffic controllers, aircraft mechanics, and those persons who design and manufacture aircraft and air traffic control equipment. For example, aircraft manufacturers will equip new aircraft such as the Boeing 767 and 757 with cathode ray tube instrumentation that replaces some of the principal dials and gauges traditionally found in the cockpits of airline aircraft. The cathode ray tube instrumentation driven by digital computers is more reliable and easier to read and thus should reduce the chance for human error. There are countless activities intended to reduce human error that are being carried out by the airlines, manufacturers, governmental agencies, and other groups. The following examples are illustrative of this broad ranging effort.

2. ATA and airline activities

Several ATA and airline activities have, as their objective, the sharing of information affecting safety.

For example, ATA conducts periodic meetings with safety representatives from ATA member airlines and some foreign airlines in attendance. The information shared in this manner is used by each airline representative as appropriate to modify recurrent training procedures, revise operating manual procedures, recommend modification of equipment, or simply to inform flight crews through safety bulletins or other company publications.

The airlines also participate in a somewhat similar program, the Aviation Safety Reporting System, run by NASA with budgetary support from FAA. Pilots, controllers and others submit safety reports to NASA which analyzers, stores, and acts upon them. Action may consist of an alert bulletin addressed to those who can take corrective action on pressing matters, or dissemination of information in periodic reports on safety matters. The NASA information is useful to the airlines and many of them provide copies to their pilots.

Each airline has its own flight crew safety program. These usually include safety publications, often prepared by pilots, which recount incidents and provide safety tips. We have provided some of these publications to the committee staff. Airlines also incorporate the latest safety information in their various training programs.

Airline flight crew training has been greatly improved through the use of simulators, and simulator training has been further improved by a recent program known as Line Oriented Flight Training (LOFT). This program consists of a typical airline flight from beginning to end but with certain added operational and mechanical problems. It supplements the usual training in FAA specified maneuvers such as steep turns, ILS approaches, engine-out procedures, and so forth. A number of human factor problems have been exposed by the LOFT method of training. For example, when confronted with pressing problems, some captains fail to use all the resources available to them, such as delegating certain responsibilities to other flight crew members or fully utilizing assistance from people on the ground. The FAA has recently revised its regulations so as to permit airlines to conduct LOFT.

This industry has led the way in both increased use of simulators and in LOFT, and we look forward to further refinement of these programs in connection with FAA's proposed new rule-making.

I have listed below in capsule form additional examples of airline human factor efforts.

A number of airlines have established special "hot lines" connecting pilot bases to central safety offices so that pilots can promptly pass along safety information at any hour of the day or night.

Several airlines are using read-outs from the flight data recorder to detect out of tolerance performance by the flight crew. When warranted, the pilot is retrained to correct the fault.

Airlines are making more extensive use of advanced simulation capabilities to provide more realistic training in areas such as: Adverse weather conditions, wet or slippery runways, wind shear conditions.

One airline conducted a two-year study of its pilot hiring process to determine the relative importance of a number of factors, including prior educational attainment and ability to learn and retain new information.

Special "road shows" to supplement normal training are conducted at pilot bases when identified needs arise. For example, when one airline found a rising trend in landing incidents—landing long, short, or veering off the runway—a special training program was developed and conducted at all pilot bases with attendance made mandatory.

One airline developed an audio-visual presentation based upon analysis of the factors that caused a particular accident. The material was used in its own pilot training programs and made available to other airlines for their use.

Less cluttered instrument approach charts have been developed to improve clarity and avoid human error.

Improved radar displays of weather information, including use of color to differentiate rainfall density, have been made available.

The examples above are primarily concerned with human errors associated with flight operations. The airlines also go to great lengths to minimize the risk of human errors caused by mechanics during aircraft maintenance. An earlier section of my testimony provided information on the scope and intensity of these efforts.

13. NASA-FAA-NTSB

The airlines have benefitted from the human factors aviation research being conducted by NASA at its Ames Research Center. The airline development of the previously mentioned LOFT training program was significantly aided by work done at Ames. Their crew resource management efforts and the resulting workshop on this subject were valuable to the many airline participants. The special studies on crew distractions, runway incursions, and altitude "busts", (that is, flight at incorrect altitudes), are examples of useful products of the Aviation Safety Reporting System program ably administered by NASA Ames. It is important that the Ames human factors work be fully supported.

The FAA, sometimes in conjunction with NASA, is conducting a number of projects which involve human factors. Our comments on them will be brief, since FAA will presumably describe them in greater detail.

Aircraft Alerting Systems. Current cockpits contain all sorts of individual aural—chimes, bells, horns, buzzers, etc.—and visual—all colors and shapes—caution and warning signals. This project is intended to provide these necessary warnings in the most orderly manner.

Head-up Displays. This joint NASA/FAA effort is concerned with the best format for displaying important flight data for approach and landing so that it can be seen by a pilot looking out a forward cockpit window.

Cockpit Display of Traffic Information. This FAA/NASA project is evaluating whether a display of nearby air traffic would be advisable.

Beacon Collision Avoidance System. There are a number of human factor aspects which must be decided before final design of this important system can be completed. This FAA project is expected to provide the necessary information.

Air Traffic Procedures Advisory Committee. This committee was established as a direct result of the fatal airline accident west of Dulles Airport in late 1974 which involved some misunderstanding between pilots and controllers. Numerous changes in procedures and phraseologies aimed at eliminating future misunderstandings have resulted from the deliberations of this committee.

The human factors work of the National Transportation Safety Board is, of course, directly related to the investigation of aviation accidents. It includes investigation, analysis, and reporting of the medical, physiological, and psychological factors involved in an accident. The Board is interested to learn not only what causes accidents but also why people make the causal errors.

In summary, the human error element in aviation accidents must be reduced. To this end, the human factor work should be directed primarily to analysis of accidents, incidents, and ATC system errors with the objective of understanding what caused or allowed the errors to be made. Where this is known, the necessary preventative action can be taken.

CONCLUSION

We appreciate this opportunity to state our views, Mr. Chairman, on the important subject of this hearing. We are pleased that the Committee is devoting so much time to safety. We wish to assure you of our determination to be of assistance, and of our interest in subsequent hearings that you may hold as you continue your oversight of aviation safety.

This completes my statement, and I will be pleased at this point to respond to your questions.

[Whereupon, at 11:30 p.m., the hearing was concluded.]

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

STATEMENT OF LAWRENCE C. CUSHING, PRESIDENT, NATIONAL ASSOCIATION OF AIR TRAFFIC SPECIALISTS

Mr. Chairmen and Members of this Subcommittee, I deeply appreciate this opportunity to appear before you and to testify on the important subject of air safety and how we might minimize human factor failures in accident prevention.

As the head of a labor union representing federal employees (Air Traffic Control Specialists/Station), I am indeed grateful that you have chosen this subject and have scheduled these hearings. Time and time again I have made statements to the Congress, and other places as well, that low morale of personnel involved with aviation safety is devastating to the achievement of air safety. These hearings will focus attention on the importance of high morale and that it is essential if safety objectives are to be realized or even approached.

The Flight Service System is part of the FAA's Air Traffic Control System and it is staffed by air traffic control specialists, as is the case of the entire Air Traffic Control System. Please believe me when I say that the morale of air traffic control specialists at flight service stations is extremely low. The reasons are fivefold and I will discuss each one in this statement.

First, the modernization of the Flight Service System is long overdue. The FAA has been giving lip service to modernization for at least twenty years but it took the Congress to force the FAA into action and to identify the old obsolete system as a safety hazard. Finally, before the Appropriations Committees for the 1981 budget request for flight service stations, the FAA Administrator admitted:

"The current system encompasses over 300 locations. It is labor-intensive, inefficient, and *does not meet user demands*. Modern aviation and technology has *totally* outstripped the FSS system as it exists today. The *air traffic terminal and enroute environments were modernized years ago* . . . and we must now move forward on FSS's." (Italics supplied)

Substandard working conditions, increased user demand, obsolete equipment, and neglect, coupled with lavish attention to other workers in the same personnel category are excellent reasons for low morale.

Second is increased user demand with a lack of sufficient numbers of personnel to handle the work load. The Senate Appropriations Committee recognized this situation in their 1980 Report (96.377) by adding 50 positions noting that: "During the last 12 years the work load on FSS personnel has increased 116 percent, while the increase in positions has only been 10 percent."

With this action and with the Administrator's admission that the Flight Service System does not meet user demands, we wonder why the FAA does not take action to eliminate this identified safety hazard by providing the additional required personnel. To provide you with a specific example, herewith attached is a recently received unsolicited letter from air traffic control specialists at Alice, Texas. Alice, Texas is representative of the situation prevailing at most flight service stations across the country. After all, general aviation suffers the third worst fatality numbers of all transportation categories (page 3, GAO Report CED-80-66, February 29, 1980). Personnel shortages are the second reason for low morale.

My third point is the pay grade discrimination between air traffic control specialists at centers and towers and air traffic control specialists at flight service stations.

Prior to 1976 there existed a one-grade separation at the highest journeyman level between center/tower personnel and station personnel. Since that date there has been a two pay grade separation. The Chairmen, Subcommittee on Civil Service and General Services, U.S. Senate, was joined by the ranking minority member in asking for an investigation by the General Accounting Office. On July 25, 1979 the report by the Comptroller General of the United States was published (FPCD-79-52) and the reason for the two pay grade separation is quoted from the GAO report (page 6, Appendix I):

"Because of the possibility of widespread *work slowdowns* by controllers the Commissioners intervened directly in the decisionmaking process. PATCO was granted a personal hearing by the Commissioners who overturned the Standards Division's position which resulted in a one-grade increase for controllers over what the Standards Division had recommended. NAATS was also granted a personal hearing, but it was unsuccessful in its appeal for higher grades for flight service station specialists." (Italics supplied)

So here we have an increase in pay grade to appease a group of federal employees because they threatened to strike, while the group that does not threaten to strike receives no consideration.

During these reclassification studies the Secretary of Transportation maintained steadfastly his position that air traffic control specialists at high volume FSS facilities should be upgraded. The cited GAO report sets forth the DoT position, ". . ., we continue to be convinced that high-volume FSS facilities should be established at the GS–12 level. Nothing in the report changes this belief or resolves this dilemma." This is the third reason for the dangerously low morale of the air traffic control specialists at flight service stations.

My fourth point relating to dangers to aviation safety and low morale for the flight service controllers is Public Law 92–297. This law, while well intended by the Congress, has resulted in a vicious caste system within air traffic control. It is devastating to station controllers. The law provides early retirement and second career training to air traffic control specialists at centers/towers and denies like benefits to station controllers. This is a major threat to aviation safety.

On November 14, 1979 the House Post Office and Civil Service Committee reported favorably a Bill relating to second career and early retirement. H.R. 1262, introduced by Congresswoman Gladys Noon Spellman, seeks to remove the discriminatory aspects of existing legislation by including air traffic control specialists employed at flight service stations and employed by the Department of Defense under the coverage provided by P.L. 92–297. The status of the Bill follows:

December 20, 1979—House Post Office and Civil Service Committee reported H.R. 1262 favorably (House Report 96–726, Part 1).

February 21, 1980—House Appropriations Committee reported H.R. 1262 adversely (House Report (96–726, Part 2) but with recommendation quoted as follows: "The Committee is cognizant of the potential for detrimental effect on employee morale resulting from the exclusion of flight service station specialists from programs such as those authorized by Public Law 92–297. The committee intends, therefore, to recommend a further review of this problem and its impact on aviation safety. The committee believes that this further study is necessary before a decision is made with respect to inclusion of flight service station personnel in this program."

July 24, 1980—Appropriations Committee directs further review and report (House Report 96–1193) quoted below: "Under Public Law 92–297 air traffice controllers can qualify for an early retirement program, but flight service station specialists are not entitled to similar benefits. In part 2 of the report on H.R. 1262, the Committee recommended a further review of this situation. This Committee reiterates this recommendation and directs the FAA, in cooperation with an independent organization, to report on this matter no later than September 30, 1981."

We are hopeful of course that the FAA will indeed proceed in this matter in an objective way, in cooperation with an independent organization, and lay aside their bias of the past. In the interest of aviation safety we are hopeful, Mr. Chairman, that you and your Committee will monitor the progress of this project.

And finally Mr. Chairman and Members, this Assoication has been negotiating with the FAA for a Contract for almost two years (two years September 26, 1980) and the end is not even in sight. The FAA has used every delaying tactic known with their very large staff pitted against our very small one.

We believe that the delay is unreasonable and capricious. It certainly is, at the very least, another contributor to low morale amongst our membership and yet amother deterent to aviation safety.

Thank you Mr. Chairman.

Attachment.

ALICE FLIGHT SERVICE STATION,
Alice, Tex., July 30, 1980.

Mr. LAWRENCE C. CUSHING,
President, National Association of Air Traffic Specialists,
Wheaton, Md.

DEAR MR. CUSHING: We, the undersigned, as Union members, are somewhat disturbed by what appears to be a total lack of planning by the Agency as far as staffing is concerned. This is carried beyond staffing to include modernization of the FSS System, but is really most prevalent in the Agency's outlook or view of staffing requirements. We feel that we need the Union's help in bringing more pressure to bear on the Agency with regard to this matter, especially here at Alice FSS. It is our belief that things are really getting out of hand.

For example, at this facility, our traffic count has risen from 141,173 in 1974 with 10 FPLs and 2 Team Supervisors to 175,705 in 1979 with 8 FPLs and 1 T/S. In addition to this our equipment remains the same as it did 25 years ago; i.e. our radio console is serial No. 5 on a contract to the Civil Aeronautics Administration and the transmitter and receiver serial numbers read like this: 154, 99, 102, 121, 117, etc. Not only are these units ridiculously old, but the structure itself is a rickety old eyesore with rats, rotting floor boards, poor airconditioning and ventillation, and is in need of roof repairs.

We feel that we can tolerate some of the above, however, we do not believe that we should be the ones to suffer due to the Agency's deplorable planning where staffing is concerned; especially when aviation was forecast long ago to grow at an astounding rate and has, indeed, done just that. As has been the Agency's practice in the past, the funds have all gone to the Tower and Center options. This practice is still perpetrated thanks to the hearty perseverance of PATCO. We at Alice feel it is time to start the wheels turning more in FSS' direction, perhaps by utilizing some of PATCO's tactics primarily in the realm of garnering more publicity for the FSS Specialists across the country.

The crux of most all of our problems here at Alice, as with many other facilities in the system, is not only obsolete equipment but primarily staffing. Since the facility is staff-critical, personnel cannot be released on bids to better themselves or their careers—whether those bids be promotional, in-grade, hardship, or whatever. The real paradox of it is this: the Chief will not release anyone until the Regional Office sends a replacement first. Since the R.O. considers 8 the normal staffing, they aren't sending any new bodies, so no one can leave Alice FSS for any reason short of resigning! Really a fine mess! Of course, the R.O. says that Congress won't appropriate the funds for additional personnel.

Also, the R.O. put out a directive recently to the effect that all available personnel be utilized to maintain 100 percent operational effectiveness, and this directive specified "including Supervisors". This has been somewhat abused here at Alice. Since Inflight, Airport Advisory, and Broadcast are combined, and Preflight and Flight Data combined, and Teletype and Weather Observer combined, we have a lot of over lapping duties, especially when only 2 specialists are on duty. Generally, the Supervisor schedules himself for a 7–3 or 6–2 and works the position of Teletype/Wx Obs. and Preflight/Flight Data with the Midwatch man and 8–4 man until the 10–6 man comes on duty. More often than not, when the 10–6 man arrives, he will go to his desk for supervisory duties leaving the 2 specialists to run an actual total of 6 positions even when things are busy. The Inflight specialist is, of course, to back up the Preflight man when the phones start loading up with briefing calls, but there's no way the 2 can answer all calls plus all the radio contacts at the same time. We've all seen hundreds of calls go unanswered simply because there's not enough personnel to answer them. Also to be noted, with the Team Supervisor scheduling himself for 7–3 or 6–2 and not rotating through any watch schedule, the specialists are forced into rotating through as many as 5 evening (4–12) watches or 5 Midwatches as opposed to day watches as the T/S counts himself in the staffing on the day watch (which, by the way, includes T/S duties and not working a position full time) so we're almost always 1 man short. If we do happen to have 3 people on duty during the day, the T/S will quite often assign one of them to training thus leaving the burden on the other specialist on duty since he has T/S duties to perform also. Things really get hectic when a person is on annual leave or sick leave. We virtually plan on overtime.

The whole problem could be solved by simply staffing the facility properly. Indeed, most of our hardships here at Alice can be traced almost directly to a lack of proper staffing. As mentioned most of the time, we have only 2 specialists on duty, and sometimes one is the T/S. If 3 bodies are present, one will quite often be assigned to training. The shortage of personnel causes the rotating watch schedule to have many short turn-arounds, and days off are frequesntly interrupted for overtime and plans made long in advance have to be abandoned.

Annual leave is also difficult to schedule when preferred, and requested "spot" leave is practically impossible to get when desired. With the T/S working to fill in on day watches, the Journeymen are forced to rotate through more evening and mid shifts disprupting family life and ruining most any type of social life.

Poor staffing causes another problem for us at Alice in that pilots who desire a weather briefing become rather irate when they get put on hold while an aircraft call is answered or they don't even get through to the Specialists because all lines are busy or the personnel are busy on other calls. Pilots get impatient and demand to know why they can't get a weather briefing and many go without a briefing and try to get one in the air. It should be noted that if a pilot gets busy flying he may well not have time to contact FSS or EFAS for a briefing. Granted, his own temper may impair safety of flight but the fact that he cannot get through to FSS, where he is supposed to be able to get a briefing, can equally affect the safety of flight. Perhaps the Agency might consider that rather than leave the FSS specialist to try to make explanations for things he has no control over. In short, morale has never been lower at Alice FSS and Management's answer is "just get the job done". We feel that getting any job done without adequate personnel is difficult, but add to that a promotional future that is bleak at best and it's a wonder that anything gets done at all!

With personnel unable to be promoted or transferred on in-grade bids, and given the R.O.'s policy (and facility management's) of getting the job done with absolutely inadequate staffing, this whole situation has become one intolerable bad joke. We just don't believe we can provide the proper service to the aviation community without decent staffing and we know this is bound to affect the safety of many pilots in the area.

We should be most appreciative if you could convey these sentiments to the powers that be in Washington and perhaps bring pressure to bear on the Agency and the Southwest Region in particular, for increased staffing. We are also writing our Congressman and Senators, and AOPA in this regard. Maybe now FSS and NAATS will receive some well deserved attention from the FAA. In any case, we'd really appreciate your help, particularly with regard to the bidding problem here at Alice and we're ready to do all we can to back you up on the overall situation.

Respectfully submitted.

RICHARD B. PAVLASEK,
Representative, Alice FSS NAATS Members.

XENEX CORP.,
August 6, 1980.

Sen. HOWARD W. CANNON,
Committee on Commerce, Science, and Transportation,
Washington, D.C.

DEAR SENATOR CANNON: The writer wishes to report, for the record, that considerations for aircraft certification and operation should take into account matters brought forth in the Petition for F.A.A. Rule Making Docket 20351.

In pertinent part, the Petition states that appropriate standards be established concerning ventilation, humidification and maximum limits of contaminants on board passenger carrying aircraft. Additionally, the Petition states that commonly 95 percent of what humidity there is on board aircraft is 95 percent perspiration and expiration from the aircraft occupants. Parenthetically, it is also mentioned that in many cases pressurization and ventilation is accomplished almost completely by uncontrolled aircraft leakage. The Petition asks that regulations be applied to manufacturers as well as operators of commercial passenger carrying aircraft.

From a safety standpoint, it is noteworthy to consider that continuous and adequate pressurization at today's common cruising altitudes is vital to the safety of crew as well as passengers. We are informed that operations of passengers carrying aircraft is permitted even in the case where back-up systems are not functioning. The writer believes this practice is an unnecessary risk factor for crew as well as passengers.

The very low relative humidity and, in most cases, grossly substandard fresh air ventilation indirectly pose as a hazard to air safety. It is well known tha dehydration of body tissues occur during prolonged exposure to an arid environment, escalating fatigue symptoms. The detrimental effects on the eye are also well known (vision is a key factor in flight crew performance). The symptoms of drowziness are well known in conjunction with poor ventilation.

The aforementioned Petition for F.A.A. Rule Making is considerably expanded in scope than the herein cited safety and certification considerations. The writer has limited the comments to these areas in conformance with the general subject matter to be reviewed at these hearings.

Inclusion of this material in the record is sincerely appreciated.

Very truly yours,

BERTIL WERJEFELT, *President.*

Enclosure.

Revised, May 20, 1980

To: Langhorne Bond, Administrator, U.S. Federal Aviation Administration, Washington, D.C.
From: Xenex Corp., 1400 Kapiolani Blvd., Suite C.4, Honolulu, Hawaii 96814

PETITION FOR FEDERAL AVIATION ADMINISTRATION, U.S. DEPARTMENT OF TRANSPORTATION, RULE MAKING

SCOPE

Federal Aviation regulations, Parts 25, 121 and others as deemed applicable.

ISSUES

Crew and public health—airplane cabin air quality standards. Contamination limits, fresh air ventilation and humidification requirements.

SUMMARY

This petition for Rule Making proposes specific standards of air quality to be provided by operators of transport category airplanes for occupants on board. Basic air quality standards are proposed as a consideration for the issuance of type certificates for transport category airplanes. Standards are proposed to apply to all operation of transport category airplanes by all carriers and commercial operators. The circumstances necessitating rule making and establishment of standards are several:

(1) Fresh air ventilation rates on board airplanes carrying passengers are oftentimes 1/5th to 1/10th the standards for fresh air ventilation required by law for minimum acceptable indoor air quality in a non-aviation environment.

(a) This poses an increased health hazard to crew and passengers.

(2) Passengers and crew complaints of physical discomfort while traveling, upper respiratory tract infection, eye irritation[1] and symptoms of dehydration, during and after travel, attributed to the low humidity on board.

(3) Presently, in most cases, 95% of what humidity there is on board, is perspiration and expiration from occupants.

The establishment of standards and enforcement thereof will provide crew and the traveling public with an environment that, from a health, safety and comfort standpoint, approaches the basic minimum standards by law enforced in the non-aviation environment.

In the interest of public health and safety, it should be noted that between 200 million and 300 million passengers carried annually by the U.S. airlines are affected as well as more than 200,000 employees and crew members of the airline industry itself. This proposed rule making is intended not only to improve health, safety and comfort of occupants on board during transit, but may well serve to reduce after effects of air travel on passengers and crew, i.e. even though the air quality on board airplanes can be deemed grossly substandard and some passengers do not demonstrate adverse symptoms during flight, incubation periods for various viruses or bacteria may render these occupants ill at a later date. Thus, this rule making is of general public health interest even to the non-aviation community.

Existing Rules, applicable to the *manufacturer* of aircraft. Air worthiness standards transport category airplanes type certificate Part 25.

Paragraph 25.831—Ventilation.

(a) Each passenger and crew compartment must be ventilated, and each crew compartment must have enough fresh air (but not less than 10 cu. ft. per minute per crewmember) to enable crewmembers to perform their duties without undue discomfort or fatigue.

(b) Crew and passenger compartment air must be free from harmful or hazardous concentrations of gases or vapors. In meeting this requirement, the following apply:

(1) Carbon monoxide concentrations in excess of one part in 20,000 parts of air are considered hazardous. For test purposes, any acceptable carbon monoxide detection method may be used.

(2) Carbon dioxide in excess of three percent by volume (sea level equivalent) is considered hazardous in the case of crewmembers. Higher concentrations of carbon dioxide may be allowed in crew compartments if appropriate protective breathing equipment is available.

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[1] One aviation medical examiner has informed Petitioner that he annually treats between 300 and 400 patients for acute eye trauma which can be directly attributed to the substandard environment on board aircraft.

(c) There must be provisions made to ensure that the conditions prescribed in paragraph (b) of this section are met after reasonably probable failures of malfunctioning of the ventilating, heating, pressurization, or other systems and equipment.

(d) If accumulation of hazardous quantities of smoke in the cockpit are is reasonably probable, smoke evacuation must be readily accomplished, starting with full pressurization and without depressurizing beyond safe limits.

(e) Except as providing in paragraph (f) of this section, means must be provided to enable the occupants of the following compartments and areas to control the temperature and quantity of ventilating air supplied to their compartment or area independently of the temperature and quantity of air supplied to other compartments and areas:

(1) The flight crew compartment.

(2) Crewmember compartments and areas other than the flight crew compartment unless the crewmember compartment or area is ventilated by air interchange with other compartments or areas under all operating conditions.

(f) Means to enable the flight crew to control the temperature and quantity of ventilating air supplied to the flight crew compartment independently of the temperature and quantity of ventilating air supplied to other compartments are not required if all of the following conditions are met:

(1) The total volume of the flight crew and passenger compartments is 800 cubic feet or less.

(2) The air inlets and passages for air to flow between flight crew and passenger compartments are arranged to provide compartment temperatures within 5 degrees F. of each other and adequate ventilation to occupants in both compartments.

(3) The temperature and ventilation controls are accessible to the flight crew.

Existing rules, applicable to *airlines* operating passenger type aircraft. Transport category airplane—air carriers and commercial operators Part 121.

Paragraph 121.219—*Ventilation.*

Each passenger or crew compartment must be suitably ventilated. Carbon monoxide concentration may not be more than one part in 20,000 parts of air, and fuel fumes may not be present. In any case where partitions between compartments have louvres or other means allowing air to flow between compartments, there must be a means convenient to the crew for closing the flow of air through the partitions, when necessary.

COMMENTS ON EXISTING RULES

The existing rules as they address public and crew health and safety are, at best, perfunctory. Regardless of the contents of Par. 25.831, the aircraft operator is only required to conform to Par. 121.219.

In contrast to the negligible concerns for crew and passenger safety expresed in this just cited paragraph, the literature teaches us that in the non-aviation environment operators of hotels, restaurants, cocktail lounges, conference facilities, etc. are by law required to provide specific air quality for occupants of, or visitors to, such premises. In many cases, the responsible agency is the Department of Public Health rather than the Building Department through its codes.

PUBLIC HEALTH RULES AND REGULATIONS

In the non-aviation environment contamination limits and fresh air ventilation for minimum acceptable indoor air quality are well documented. Most commonly, rules and regulations pertaining hereto are established by state and federal departments of public health. Basis for these rules and regulations are, in many cases, derived from standards established by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Enforcement is effected through various state and federal agencies, such as Building Departments, Department of Public Health, Department of Occupational Safety and Health and others. The various regulations and standards address specific criteria as well as generalized circumstances. In brief, as they apply to a comparable environment to passenger transport aircraft. We find the following:

1. *Minimum Fresh Air Requirements.* For an estimated occupancy of 150 persons per 1,000 sq. ft. of floor area, fresh air ventilation requirements are minimum 35–40 cubic feet per minute per person (cfmp). In many cases, occupancy per 1,000 sq. ft. of floor area on an aircraft exceeds 150. 200 more closely approximates the circumstance on board aircraft. Unfortunately, the ASHRAE standards, for instance, do not anticipate such large densities. However, by straight line interpolation one will find that the appropriate fresh air ventilation rates should be at least 50 cfmp.

2. *Maximum Contamination Standards.* Excepting obvious detrimental contaminants such as carbon dioxide, carbon monoxide, sulphur oxides, nitrogen oxides,

ozone, and others, for which specific threshold limit values (t.l.v.) are established by the American Conference of Governmental Industrial Hygienists, other contaminants are dealt with on a subjective evaluation basis.

Standards for the control of bacteria, fungus, spores, virus, in general the containment of contageous disease, is only addressed in special applications i.e., hospital operating rooms. It can be surmised, however, that the minimum ventilation rates previously described serve as basic tools for the removal or avoidance of accumulation of disease causing contaminants.

Due to the exceedingly high occupancy rate per square foot on board an aircraft, exceeding that anticipated by any public health regulations, this entire issue deserves consideration by appropriate professional bodies such as the American Medical Association, the Center for Disease Control and others.

3. *Relative Humidity Limits.* Some public health regulations and ventilation standards address the issue of relative humidity (RH) in ambient air. Unfortunately, there has been little need to consider this issue other than in a subjective manner relating to comfort. Humidity is so much a part and necessity of our daily lives that it is virtually taken for granted that minimum levels, from a health standpoint, are always attained. The basic problem confronting air conditioning engineers most commonly relate to the removal of excess humidity. The recommended levels of RH are between 30 and 60 percent depending on the room temperature.

COMMENTS

Contamination limits, fresh air ventilation and humidification requirements relating to the non-aviation environment are well documented. Detailed information is readily available through most departments of public health and building departments as well as the numerous professional organizations engaged in these fields. The most widely adopted standards are those of the ASHRAE.

BRIEF BACKGROUND, AIRPLANE CABIN AIR QUALITY STANDARDS

Contrary to popular belief, the air qualify on board aircraft usually is only a fraction of the minimum health standards found in comparabel environments on the ground.

The problem is one of insufficient fresh air ventilation compounded by insufficient humidity; moreover, what humidity there is aboard a plane is 95 percent unsterilized perspiration and expiration from fellow occupants. Body odors of external as well as internal origin further impair the air quality.

The airline industry for three decades has recognized that fresh air should be supplied into a plane's cabin at a rate of 30 to 50 cfmp. This is the implied recommended minimum level by the ASHRAE for a comparable environment on the ground.

Because of technical complexities associated with providing this amount of fresh air—namely an unbearable low relative humidity on board—the industry for the past thirty years has provided only 15-20 cfmp of fresh air. By reducing the input of fresh air to these levels, the relative humidity on board rises from as low as 4 percent to as high as 12 percent, the latter still being less than in most desert areas of the world.

With the recent advent of the fuel crisis, however, airlines have reduced the input of fresh air still further, to between 5 and 7 cfmp for "fuel conservation measures". By doing so, the relative humidity rises to a high of approximately 20 percent (almost all perspiration and expiration). In order that passengers have a feeling of reasonable ventilation, approximately 70 percent of the used air is recirculated". In some cases, this recirculated air is filtered for small particles. The cockpit crew is, by a separate ventilation system, provided essentially 100 percent fresh air.

In order for the airlines to provide adequate humidity, at minimum ventilation rates of 30-50 cfmp it would be necessary to carry on board, for a 5-8 hour flight, several thousand pounds of water. Additionally, they would have to carry extra fuel for the carriage of this water and, at the expense of freight revenue, provide space for the water. In the ultimate, these circumstances impose an economic burden to the consumer who, in turn, will have to pay a higher price for air travel.

Presently, the reduced ventilation rates commonly found on board an aircraft provide a savings to airline operators. Based on average aircraft utilization and load factors, this amounts to approximately 50 cents per transcontinental passage.

Recent developments in the field of aviation environmental control systems indicate that it may be possible to provide "full" ventilation and 30-50 percent RH within economically acceptable boundries. This, in contrast to the state of the art over the last three decades where adequate ventilation and humidification carried a high price tag to the consumer and industry.

In light of the health standards that people from developed nations now take for granted in the nonaviation environment, we see no reason that like standards should not be applied in aviation, especially so since the fresh air ventilation rate in many instances, is 1/10th of what is otherwise termed the minimum health standard. Additionally, low ventilation rates cause accumulation of undesirable contaminants and odors on board. This, is part, owing to the fact that humidification is accomplished almost in total from the perspiration and expiration of occupants on board. Parenthetically, in many cases, pressurization and ventilation on current aircraft results almost exclusively from uncontrolled aircraft leakage.

PROPOSED RULES

Petitioner recognizes that relevant industrial organizations involved in aviation, as well as employee unions of these industries, along with state and federal agencies and professional associations, will contribute to the final formulation of acceptable regulations pertaining to fresh air ventilation, humidity and contamination limits. The rules proposed herein are of a basic and preliminary nature taking the aforementioned fact into account. In all likelihood, due to the unique and very congested nature of the aircraft environment, the ultimate regulations may have to be more stringent in order to properly address basic health, safety and comfort standards for crew and public.

It is proposed that Par. 121.219—Ventilation, be deleted and replaced as follows: Par. 121.219—Cabin Air Quality Standards. All passenger and crew compartments shall be ventilated with fresh air at the minimum rate of 35 cfmp. where occupancy density is below 120 persons per 1,000 sq. ft. of floor area; at a minimum rate of 50 cfmp for occupancy density between 120–180 persons per 1,000 sq. ft. of floor area; and at a minimum rate of 65 cfmp for occupancy density of over 180 persons per 1,000 sq. ft. of floor area.

Uncontrolled aircraft leakage shall be maintained at less than 20 percent. Contaminants shall be maintained at 1/10th of the t.l.v. as established by the American Conference of Governmental Industrial Hygienists. Relative Humidity at all times shall be maintained between 30 and 50 percent. Water used to provide said humidity shall be free of organic and chemical compounds in accordance with acceptable public health standards for potable water as defined by the American Conference of Governmental Industrial Hygienists. The vapor in the air on board shall, at no time, be composed of more than 20 percent unsterilized perspiration and expiration originating from occupants on board. The air on board shall be free of offensive odors.

Concern for the health of passengers and crew mandates that suitable monitoring of air contamination by various pathogens (bacteriological, viral and fungal) causing diseases be instituted. Further, in this regard, the allowable quantity of properly filtered recirculated air shall never exceed 7 cfmp.

All values herein described, where applicable, shall be adjusted to sea level equivalent.

Failure to comply with the minimum requirements above stated shall be deemed sufficient justification for the administrator to deny a certificate holder further use of said aircraft for the purpose of passenger-transport until such time that compliance is demonstrated. Repeated failures to comply, where the operator cannot demonstrate justifiable cause, shall be grounds for the administrator, after appropriate notice and hearing, to impose fines up to a maximum of $——, in addition to denying the certificate holder the right to transport passengers.

Operator and certificate holder of said aircraft, at the request of the administrator, shall permit the F.A.A. to monitor, with its equipment, passenger carrying aircraft, to ascertain whether there is compliance with the standards set forth.

Notwithstanding the foregoing provision, the administrator may require that the operator demonstrate by supportive engineering data that operator is capable of compliance.

It is further proposed that FAR 25.831—Ventilation be approximately amended to conform to the standards reflected in the new proposed FAR 121.219—Cabin Air Quality Standards.

COMMENTS TO PROPOSED RULE 121.219

It is believed that the strict enforcement of this rule will substantially reduce passenger and crew upper respiratory tract ailments, eye irritation and ailments and dehydration symptoms and in general, provide a much needed improved environment for occupants on board aircraft. The spread of contageous disease will be substantially reduced. Further, enforcement of these rules will bring the aviation industry to health standard parity with other industries dealing with the public.

It may at first appear that the economic burdens imposed on the industry by these rules would be excessive, however, recent advances and continued development and improvement of environmental control systems negates this argument. Previously, aside from capital expenditures for equipment installations, the cost to the U.S. industry for complying with these regulations would have been on the order of several hundred million dollars annually. Recently proposed ECS's appear to reduce these expenditures to less than 1/20th. As in other similar cases, the economic burden relating to this rule will be borne by the consumer. In today's market the cost to the consumer translates to approximately 20 cents per transcontinental ticket—approximately 1/10th to 1/20th the cost of an average meal on board.

Is it reasonable to make the foregoing demand on the aviation industry? Yes, considering that all other industries similarly situated are forced by law, for public health reasons, to comply with these basic public health requirements. The human requirements for fresh and uncontaminated air are undiminished whether or not there is a fuel crisis or other factors affecting the cost of providing such service.

Reference materials and bibliography are, in part, apparent from the Petition. Additional information and references to further substantiate credibility and veracity of this Petition are available upon request from Xenex Corporation, 1400 Kapiolani Blvd., C-4, Honolulu, Hawaii 96814.

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